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Science and Exploration for Curious Kids

Volume 22, Number 4 April 2023

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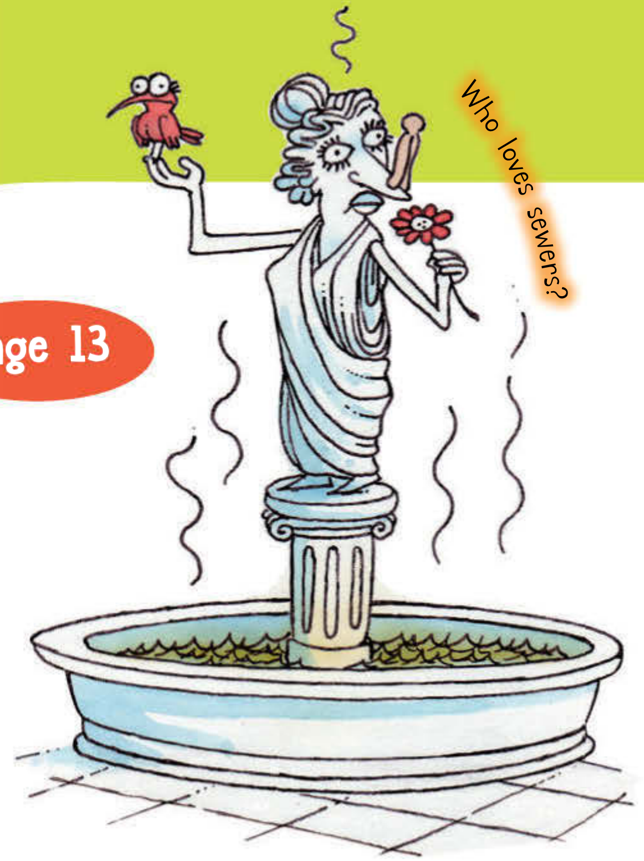
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NOSY NEWS

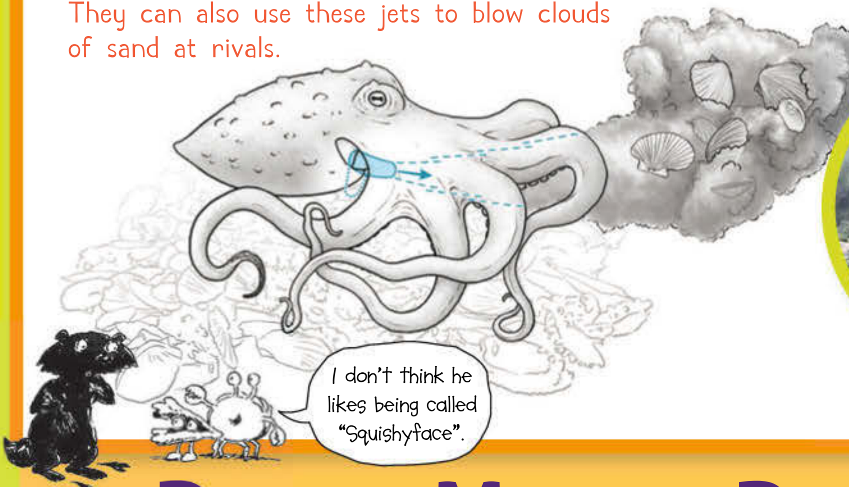
by
Elizabeth
Preston

Duck! It's an Octopus!

Octopuses usually live alone. But some Australian octopuses live crowded together—and it might make them grumpy. Scientists have caught them throwing things at each other.

The scientists used underwater cameras to film a species called gloomy octopuses. The octopuses often fling shells away after eating. Sometimes they also threw algae or sand by holding the material in their arms, then letting go while squirting a jet of water. They might just be clearing their spaces... but they quite often hit other nearby octopuses. From studying the videos, the scientists think it was on purpose.

Octopuses move by squirting jets of water. They can also use these jets to blow clouds of sand at rivals.

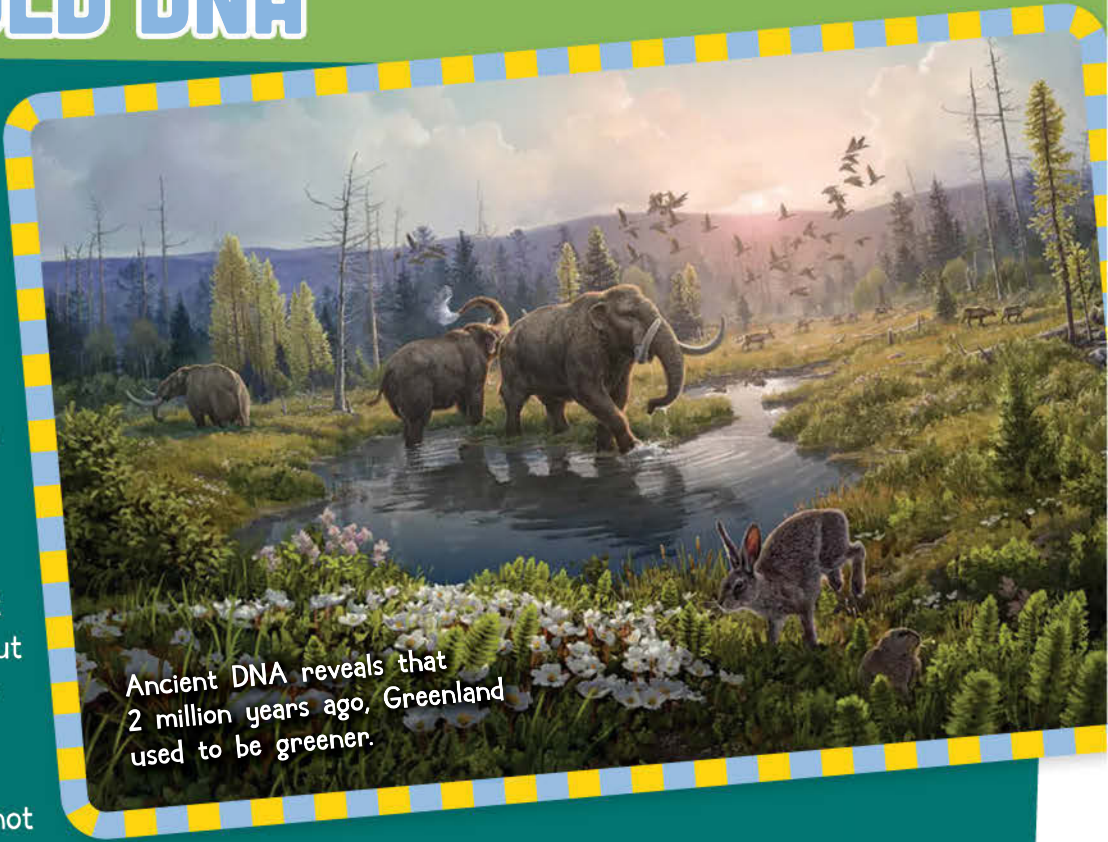

I don't think he likes being called "Squishyface".

Plant Makes Prank Poop

Dung beetles have a dirty job. They collect animal poop, make it into balls, and roll it away to bury it. They use the dung for food and to lay eggs in. One plant in South Africa has a trick to fool the hard-working dung beetles. It makes seeds that look—and smell!—just like antelope poop.

The plant is called *Ceratocaryum argenteum*. Its seeds are round, brown, and bumpy. When dung beetles roll the fake poop away, they help spread the plant's seeds. But the seeds don't do any good for the beetles. So to the bugs, it's a pretty dirty trick.

OLD, COLD DNA



Ancient DNA reveals that 2 million years ago, Greenland used to be greener.

DNA is a twist of molecules that carry the instructions for making a living thing. There's some in almost every cell. When plants or animals shed cells (in poop, fur, or leaves), a bit of DNA is left behind too. Scientist detectives can look at this DNA to figure out what life form left it behind.

DNA breaks down over time, and does **not** survive in rock fossils. But high in Greenland, near the top of the world, scientists searched for DNA in the ice. They dug down deep to find ice that was buried long, long ago. And they found the oldest DNA anyone has ever discovered. It was left behind at least two million years ago, preserved by the ice.

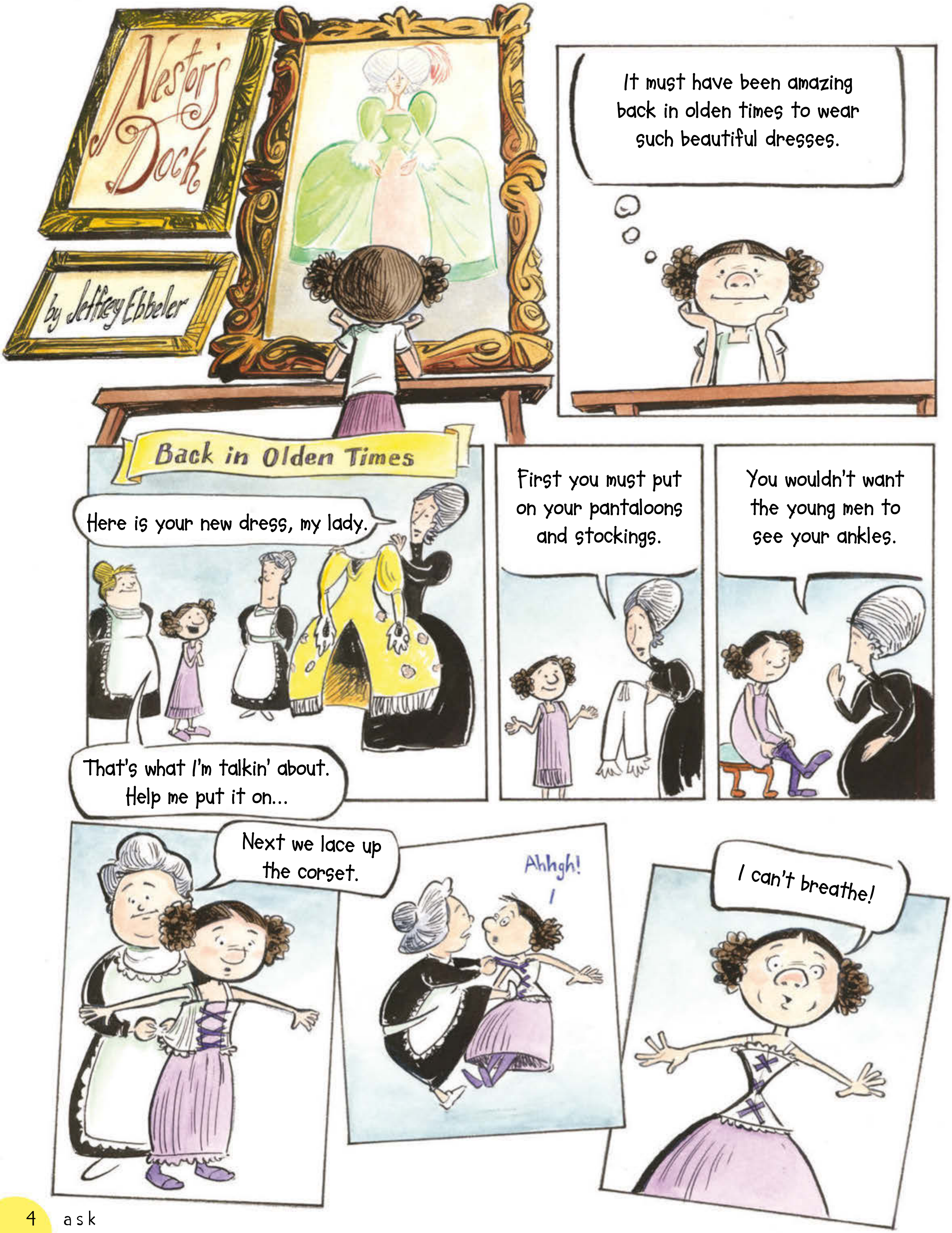
Reading the DNA, scientists could get an idea of what animals and plants lived in Greenland back then. They found the DNA of birch and poplar trees, as well as reindeer, geese, horseshoe crabs, and giant mastodons.

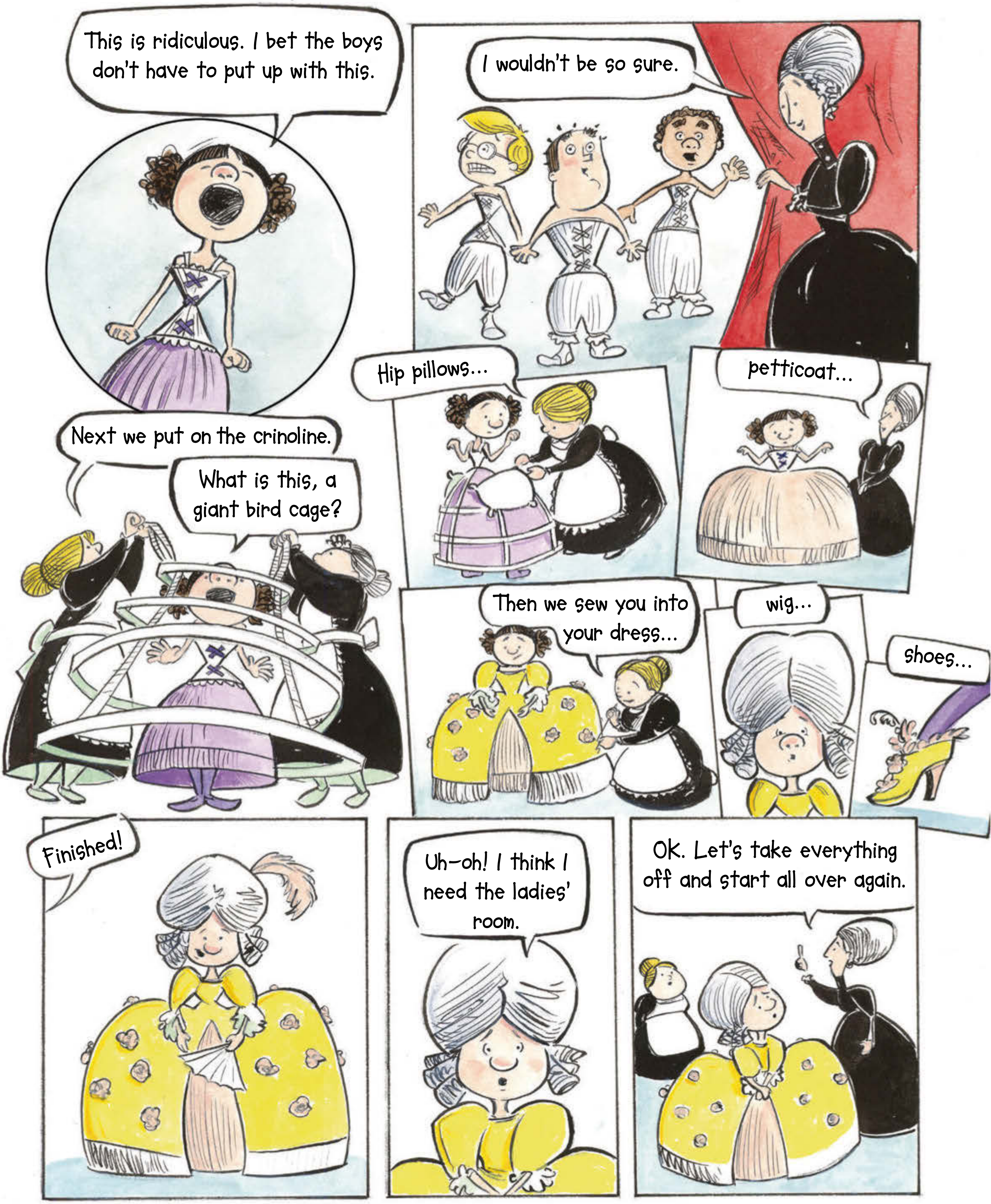
poop

Pick me, I'm better.
That is one sneaky plant.

seed

confused beetle


Nestor's Dock
by Jeffrey Ebbeler
It must have been amazing back in olden times to wear such beautiful dresses.
Back in Olden Times
Here is your new dress, my lady.
That's what I'm talkin' about. Help me put it on...
First you must put on your pantaloons and stockings.
You wouldn't want the young men to see your ankles.
Next we lace up the corset.
Ahhgh!
I can't breathe!


This is ridiculous. I bet the boys don't have to put up with this.
I wouldn't be so sure.
Next we put on the crinoline.
What is this, a giant bird cage?
Hip pillows...
petticoat...
Then we sew you into your dress...
wig...
shoes...
Finished!
Uh-oh! I think I need the ladies' room.
OK. Let's take everything off and start all over again.

What's Under THERE?

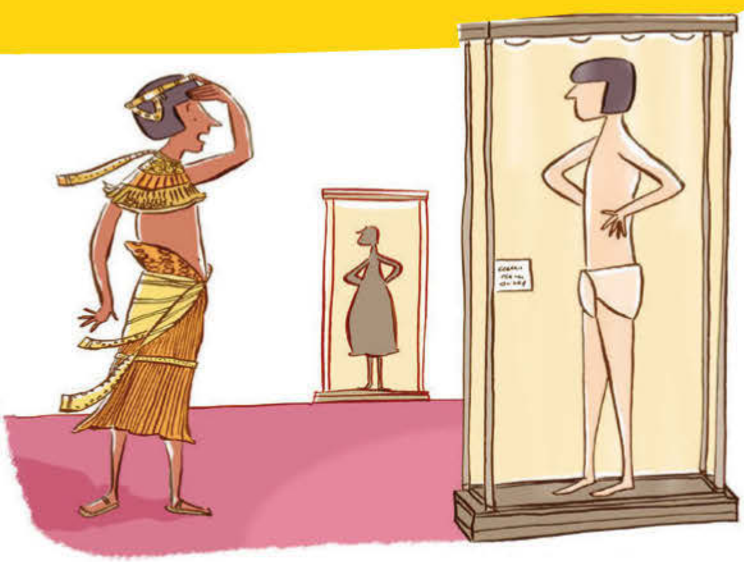
art by Adam Larkum

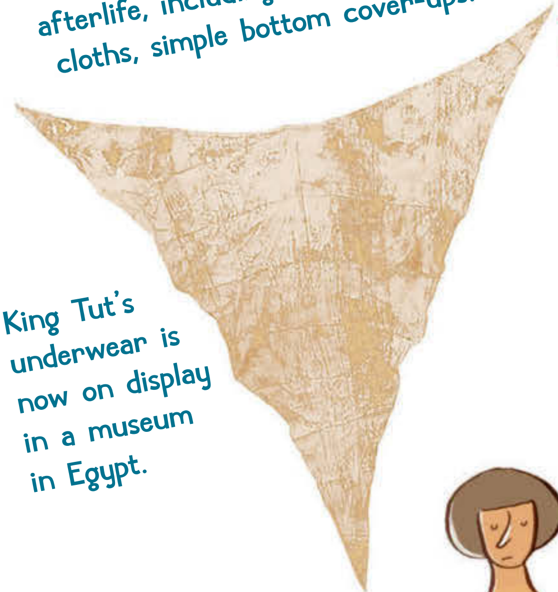
Knights and knaves, princesses and astronauts—have you ever wondered what they're wearing underneath? We hope so, because we're about to tell you.

I see London,
I see France,
I see King Tut's
underpants!

King Tut's Undies

In 1323 BCE, the Egyptian boy king Tutankhamen was buried with lots of things that he might need in the afterlife, including 450 linen loincloths, simple bottom cover-ups.





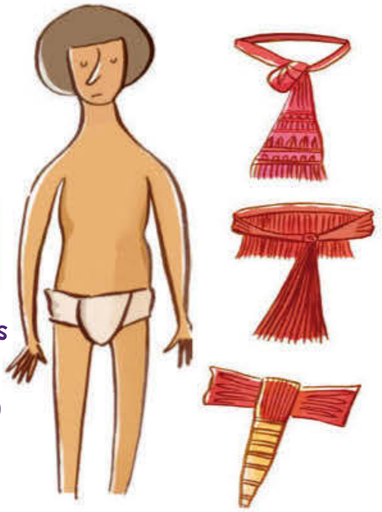
King Tut's underwear is now on display in a museum in Egypt.

To put it on, he tied the top ends of the triangle around his waist, brought the long end up in front between his legs, and tucked it over the knot.

King Tut wore the same kind of underwear as everyone else—but his was made of finer cloth.

A Private Party

For much of history, loincloths were the favorite underwear (and sometimes the only wear) for men, women, and kids all over the world.

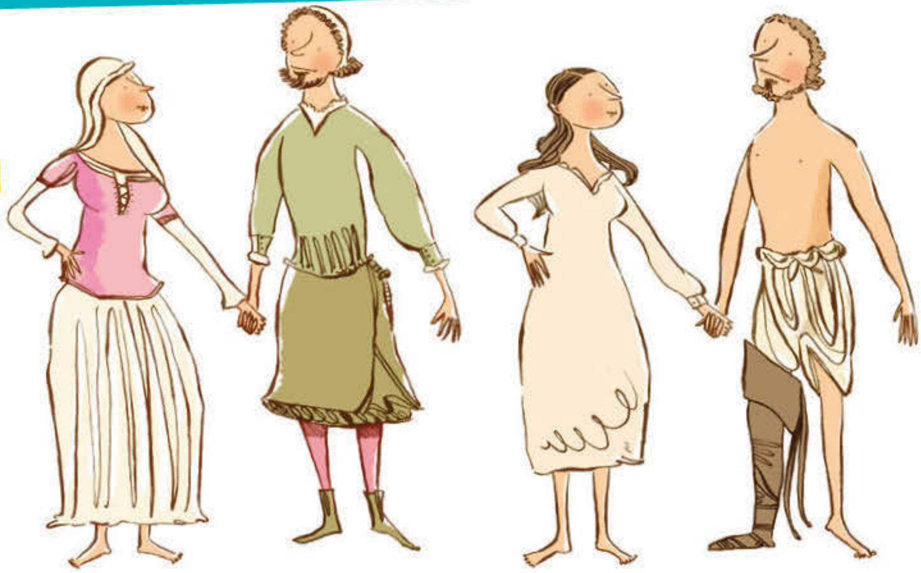


Loincloths came in many styles, from simple triangles tied around the waist to fancy bands with beads and fringe. But whatever the style, they did the basic job of all underwear, protecting sensitive areas from splinters and scratches, and keeping private parts private.

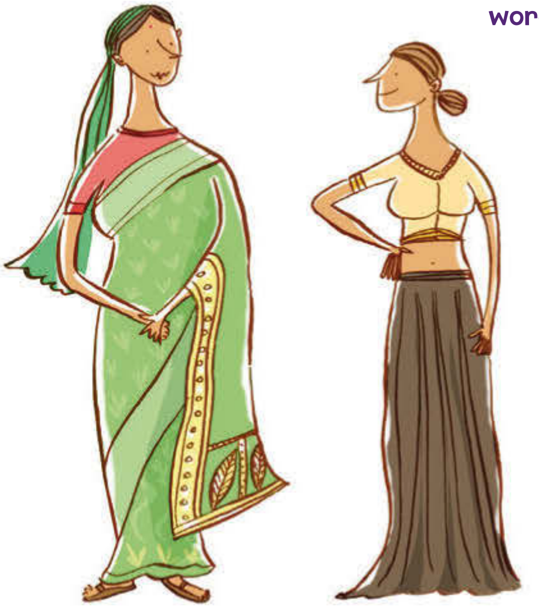
Eventually, when people began to wear other things over their loincloths, underwear was born!

Keep Your Shirt On

In medieval times, the basic undergarment for men and women, from the king to the poorest beggar, was a knee-length shirt called a shift or smock. It was made of linen, cotton, or wool.



People wore their shifts all the time, day and night. At night they slept in them. When they got up, they put their day clothes on top. Fancy clothes were often not washable, so a shift underneath helped keep the expensive outer clothes clean. Men sometimes wore loose undershorts called braes and tie-on leggings.



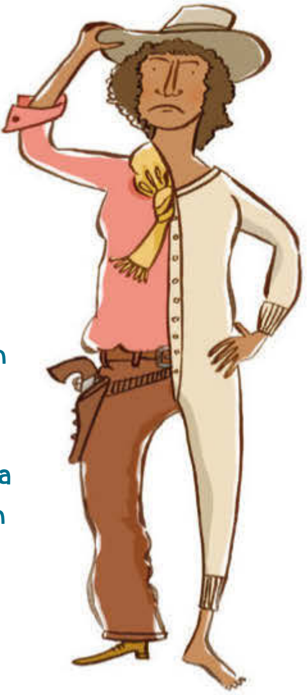
In India, women wrap their saris over short tops and underskirts.

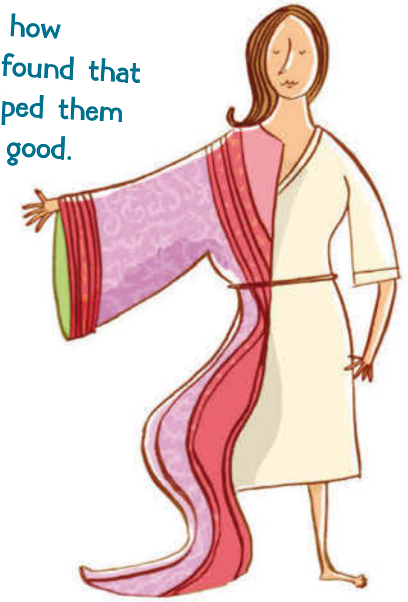
Under There Everywhere

Around the world, no matter how different the fashions, people found that having a layer underneath helped them keep clean, warm, and looking good.

I don't think you wear it like that

In the American wild West, the favorite cowboy underwear was a one-piece woolen union suit.



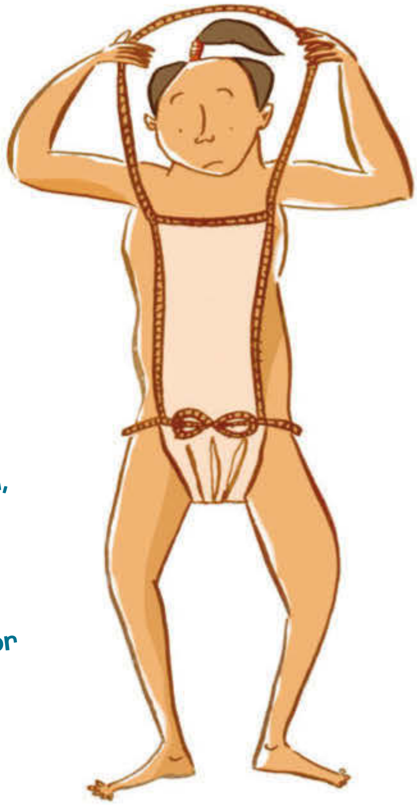


In Japan, dress-up kimonos are layered—sometimes 12 kimonos at once. Under them all is a thin underwear-kimono called a *hadajuban*.

Sometimes underwear is called upon to do a little more.

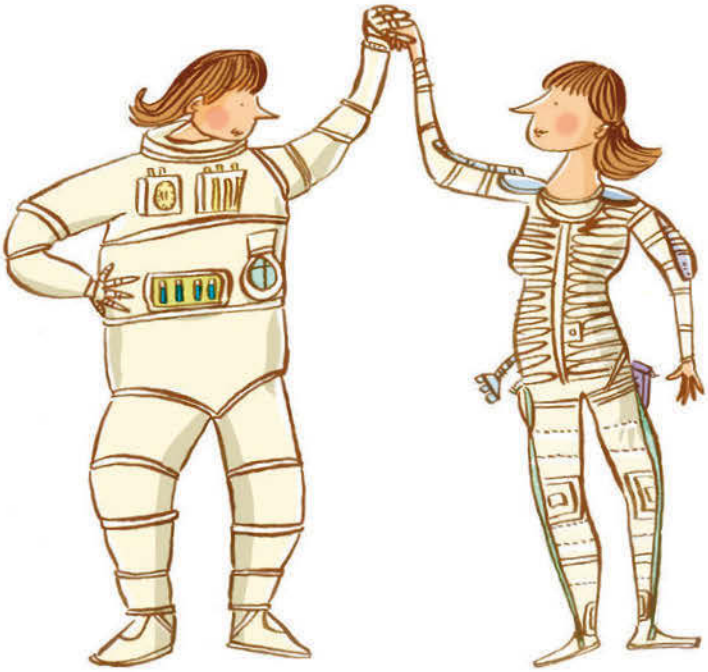
Samurai Style

Traditional Japanese samurai warriors wore kimonos and wide pants under their armor. Under all that was a special loincloth called a *fundoshi*. Battle fundoshi had a front panel with a loop around the neck. In Japan, "tighten up your fundoshi" means the same as the English saying "pull up your socks"—get ready for a challenge.



Up and Under

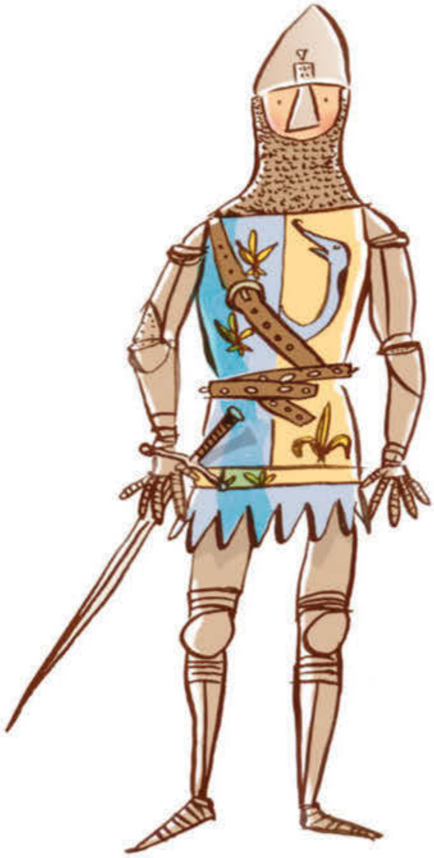
What do astronauts wear under their spacesuits? Space underwear! These light, long-sleeved suits have small water tubes sewn all over them. Cool water is pumped through the tubes to keep astronauts cool in their stuffy spacesuits.

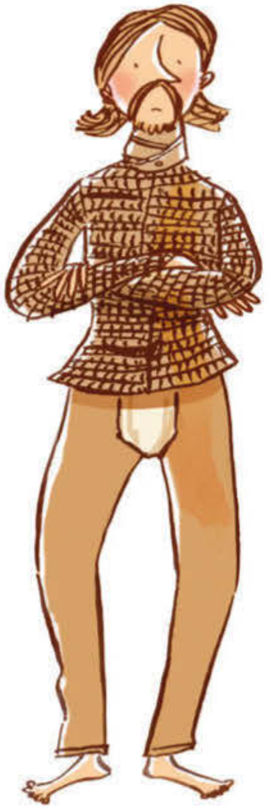


And because space walks can last a long time with no bathroom break, under the cooling suit astronauts also wear space diapers.

Cushy Knights

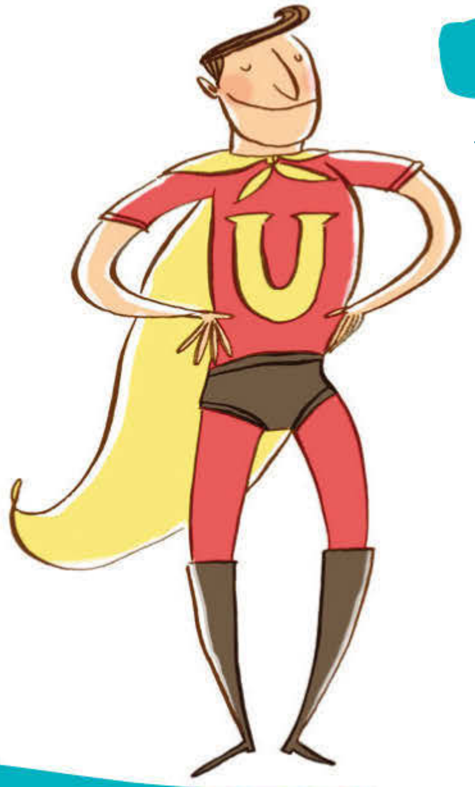
Under their heavy metal armor, knights wore thick quilted undershirts and pants. This kept the metal from rubbing and scratching, and gave extra protection against troublesome swords and arrows.



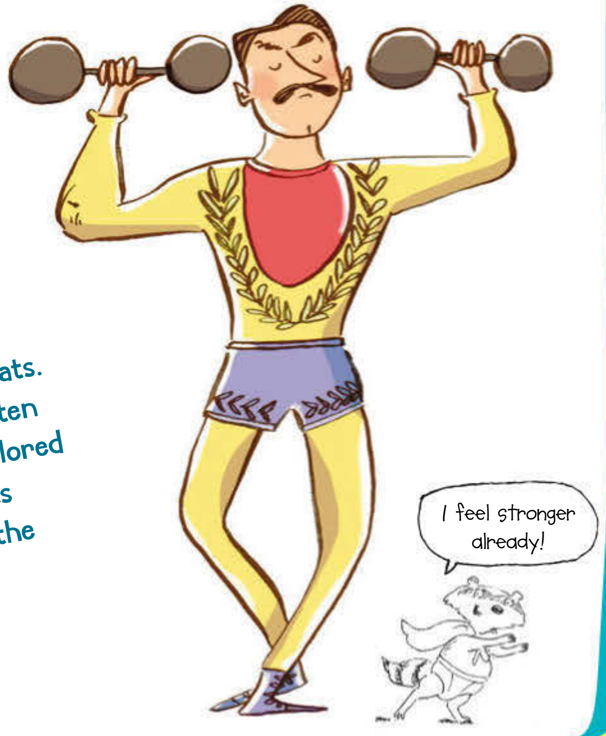


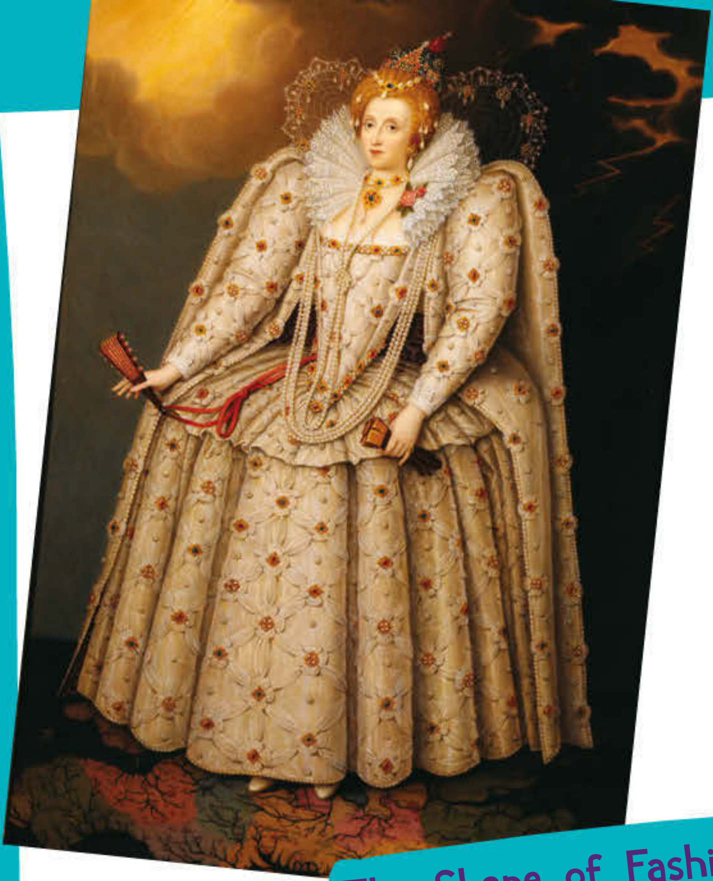
King James I of England was so terrified of being attacked by knife-wielding villains that he wore padded undershirts all the time, even when he wasn't in armor.

Superwear!

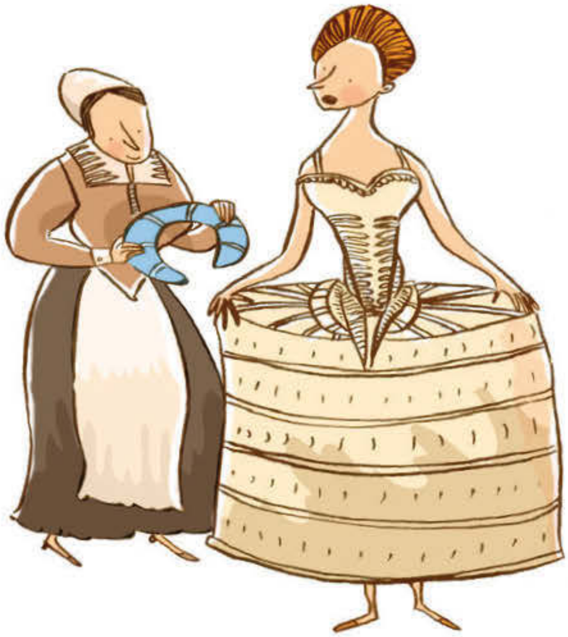


Why does Superman wear his underwear on the outside? Back in the 1930s, cartoonists modeled the costumes of the first comic-book superheroes on the outfits of circus strongmen and acrobats. These performers often wore shorts over colored leotards—which looks like underwear on the outside to us.


I feel stronger already!



Between 1500 and 1900, many fancy fashions called for some serious underwear.



The Shape of Fashion

Here is Queen Elizabeth I of England in 1592. What an amazing dress!

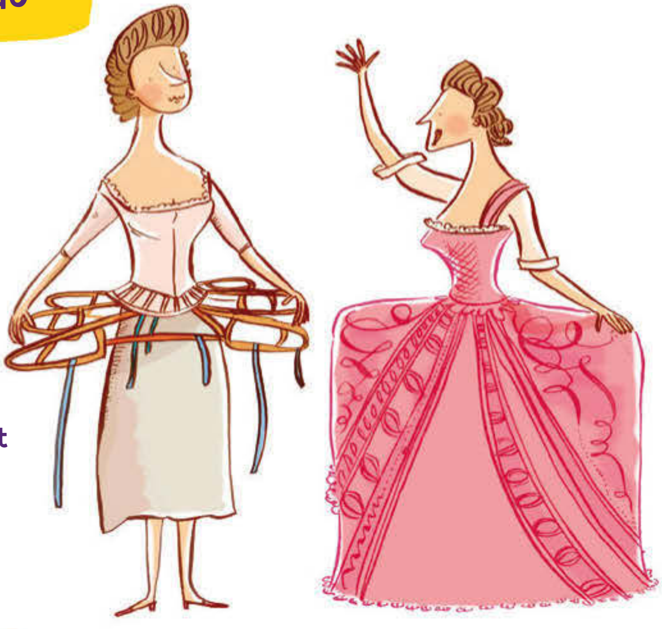
That dress must weigh more than she does!

Underneath, the queen has on an underskirt with stiff wooden hoops, called a farthingale. This holds up the wide overskirt. A sausage-shaped roll of cloth, called a bum roll, ties around the waist to keep the dress from sagging in back.

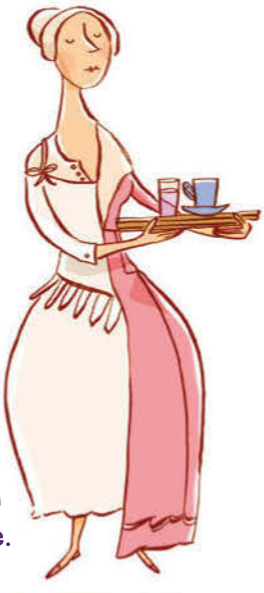
But (sssh!) the queen probably wasn't wearing any underpants. Underpants for women didn't become common until the 1800s.

The Wide Side

This contraption, called a pannier, is a wooden frame designed to hold a skirt out sideways. It was fashionable in the 1700s. Some skirts were so wide that women had to turn sideways to get through doorways. And sitting down was tricky.

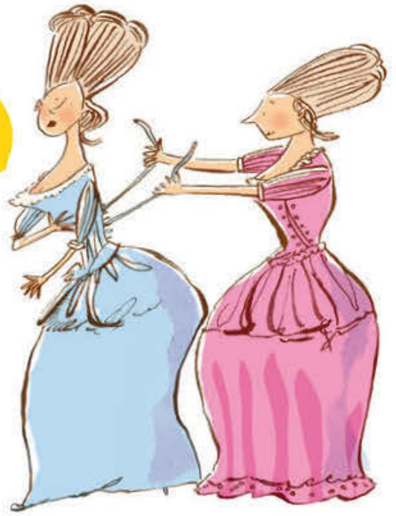


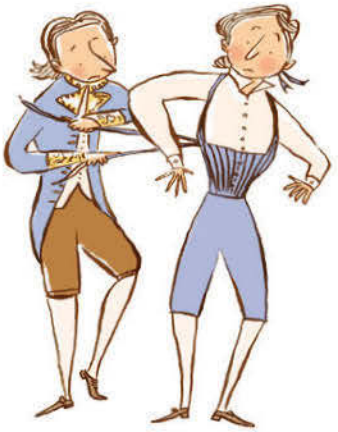
Of course, most ordinary women had work to do and didn't go around in enormous skirts. Instead, they wore a couple of underskirts, or petticoats. This was warm and looked nice.



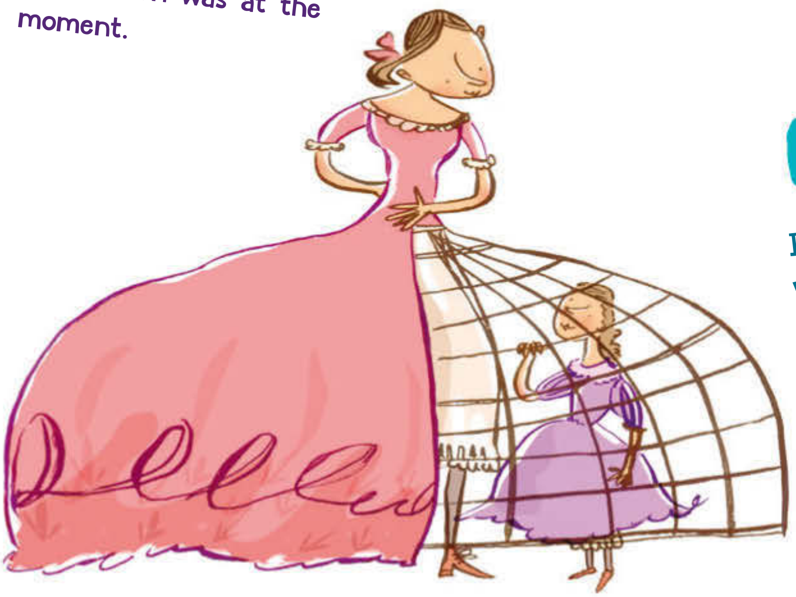
Tight on Top

On top, fancily dressed women wore corsets—lace-up vests stiffened with slats of bone or metal. Corsets shaped the body to the dress, making the waist look small and the chest look round, or flat, or whatever the fashion was at the moment.





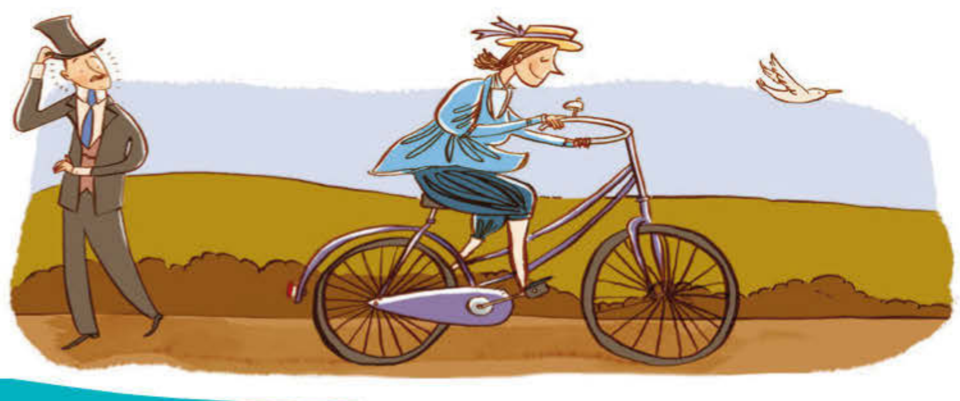
Men wore corsets too, to keep their tummies flat and make them sit up straight.



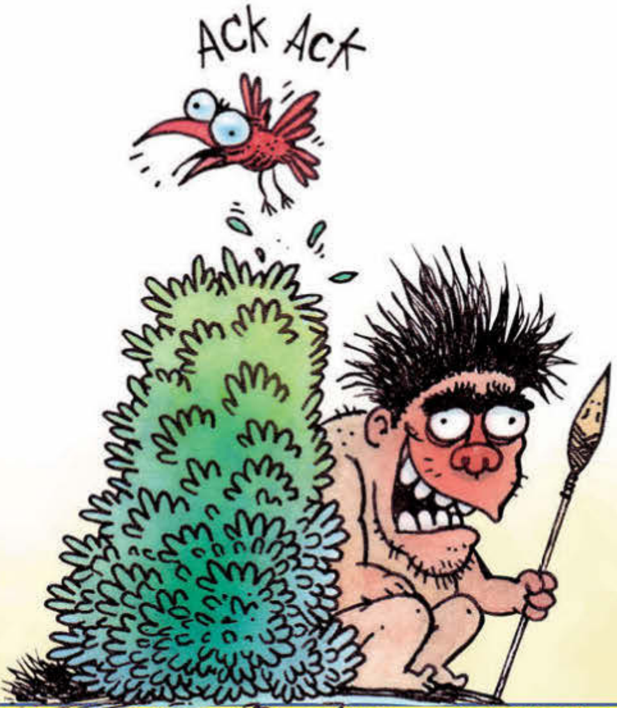
Belle of the Ball

In the 1850s, skirts got REALLY big. They were held up by a wire frame underneath called a cage crinoline. These skirts had an alarming tendency to flip up in strong winds, so around this time more women started wearing knee-length underpants called pantaloons.

Bicycles finally put an end to the age of corsets and big skirts, around 1900. Women loved the freedom of bikes—but it was hard to ride in long skirts and stiff corsets. So some daring women started biking in short dresses and baggy pants called bloomers. At first this was considered quite shocking, like wearing your underwear in public. But soon all women gave up heavy metal underwear, and though fashions still come and go, comfort is back in style.



And what's under HERE? Well, you know.



Toilets for Everyone!

From Pit

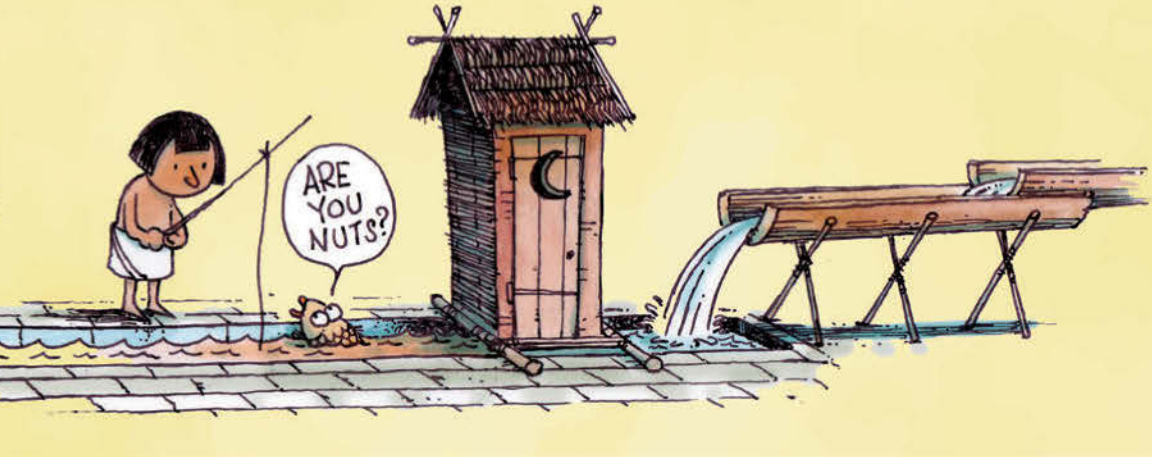
You probably take that porcelain throne in your bathroom for granted. But where did it come from? And where did people go before?

Toilet! Tee hee!
The...um...necessary room is serious business!
What's the "necessary room?"
She means the bathroom. The lavatory.
The commode. Potty. Water closet. Loo.

It's All about Water

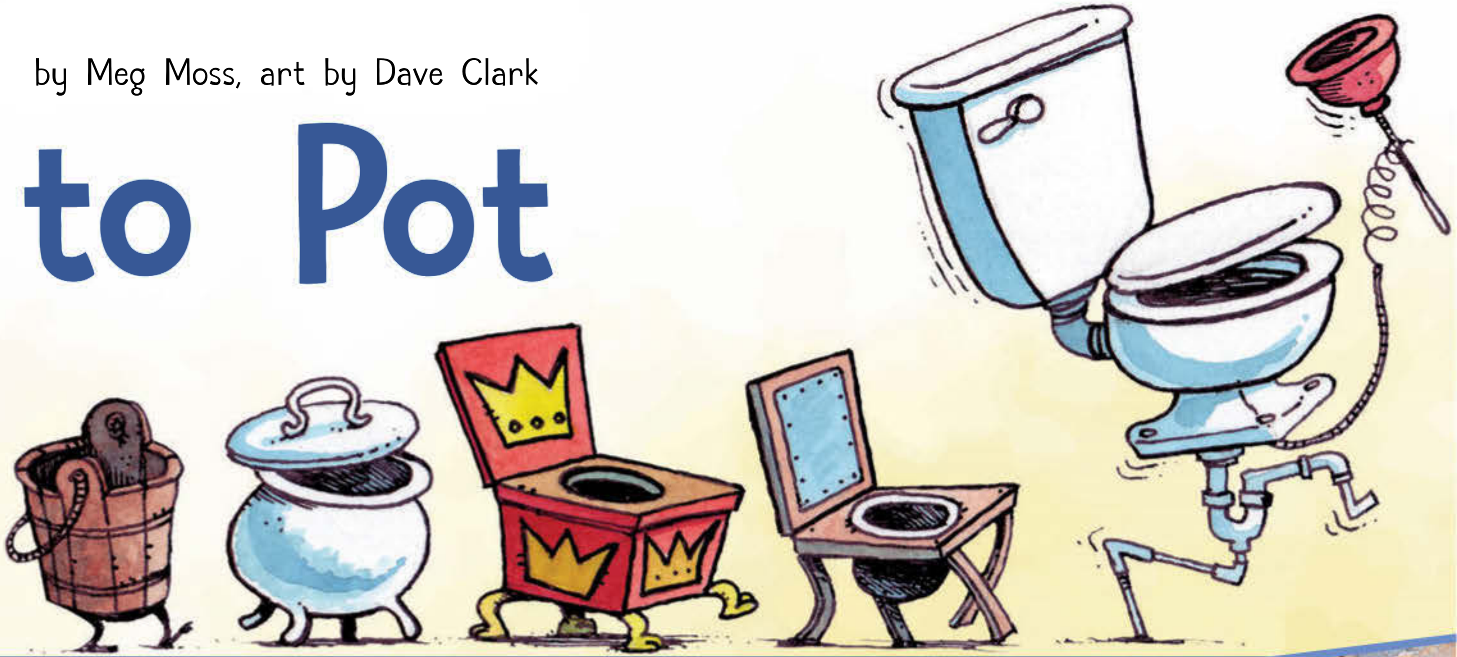
If you have running water and flushing toilets, it's because your house is connected to a sewer system. This means that water from a reservoir or lake flows through pipes into your home, and dirty water gets pumped away again through sewer pipes to be cleaned in a water treatment plant. Or perhaps your house draws water from a well, and dirty water flows into an underground tank called a septic system. Either way, it takes water.

Even 5,000 years ago, people understood how useful water could be to carry away waste. They built pipes to bring water from rivers and lakes, or from tanks that filled up with rainwater. In some villages in ancient Scotland and India, people pooped and peed into holes directly above water-filled drainage ditches. In other places, people buried pipes to carry waste away: the first sewers. They even had the idea to build sewer pipes with a slant, so that dirty water flowed naturally downhill, back into rivers.


ARE YOU NUTS?

by Meg Moss, art by Dave Clark

to Pot

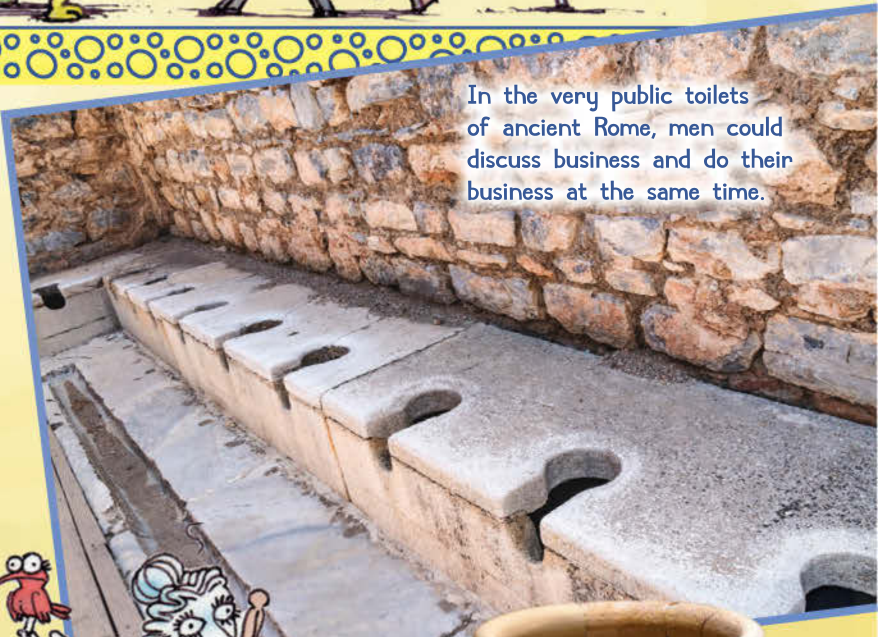


The Sewer Goddess

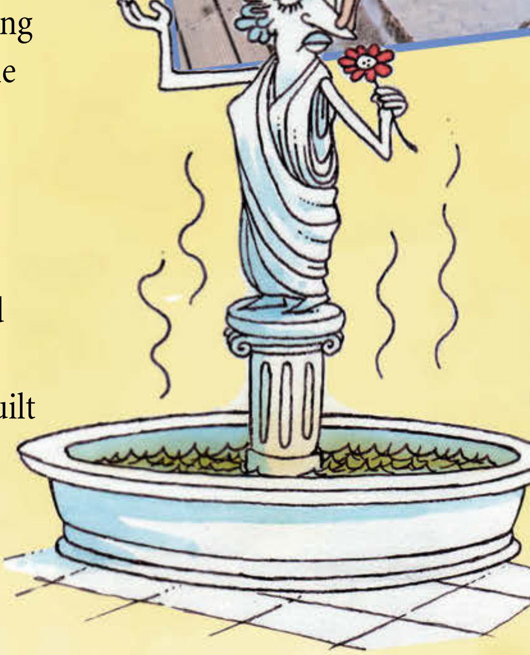
The ancient Romans liked to do things in a big way. They built huge aqueducts—stone water channels that carried lots of water a long distance. These brought water into the city, where it flowed into fountains, homes, bathhouses, and public toilets. *Really* public toilets.

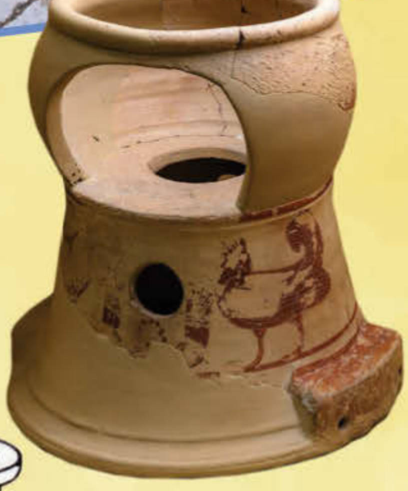
Romans weren't shy about using the bathroom. Men would chat, gossip, and poop while sitting on rows of stone toilet seats in the public facilities. Underneath ran a channel of water to remove the waste. Most of it flowed into the Tiber River and out to the sea.

The Romans were very proud of their sewer, called the Cloaca Maxima, or Great Sewer. They built a shrine to Venus Cloacina, goddess of the sewer, directly over its main branch.

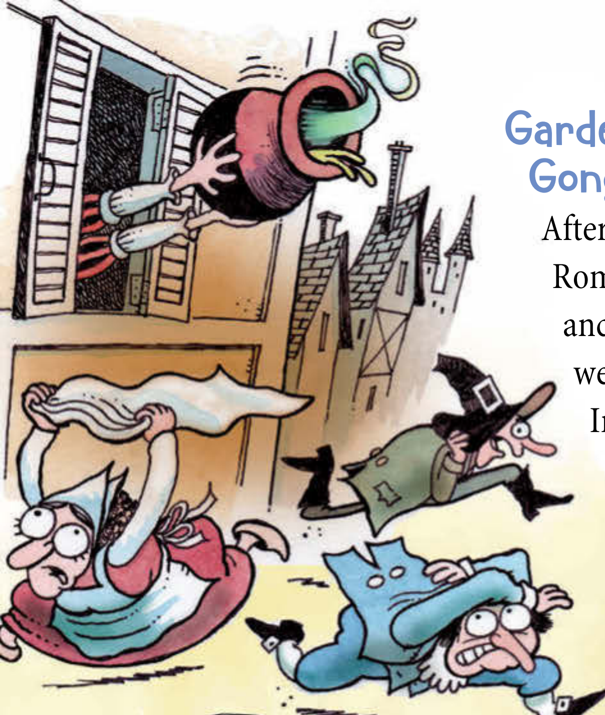


In the very public toilets of ancient Rome, men could discuss business and do their business at the same time.





This pottery potty was used by a child in ancient Greece.



Garderobes and Gongfermors

After the fall of Rome, many useful ancient inventions were forgotten. Including sewers. For centuries, people all over Europe returned to a simpler way of disposing of waste—they threw it outside. This created dirty and stinky problems and a lot of disease, especially in crowded cities.

Inside houses, people did their business in small chamber pots, then emptied them out the window onto the street below. With good aim, the waste might go into a ditch. Or not. “*Gardez l’eau,*” they’d cry in France (“Watch the water!”) to warn passers-by of the stinky shower about to land on their heads.

Or they might use an outhouse. This was basically a seat over a pit, where the waste fell. When it filled up, it was cleaned out by gongfermors, workers who spent the night emptying cesspits and carting the waste out of town. Sometimes they sold it to farmers for fertilizer. They worked at night to keep the stink away from the daytime streets.

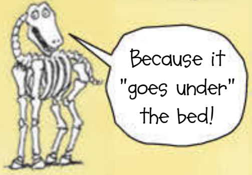
It wasn’t much better in the castles. There, the bathroom was a small room called a garderobe that stuck out over a moat or perhaps just dry ground below. An open hole in the floor served as a toilet. The user simply sat above the hole and let waste fall. Bombs away! This made the moat extra revolting to cross. But some people also hung their fancy clothes in the garderobe, thinking that the smell would keep away moths.

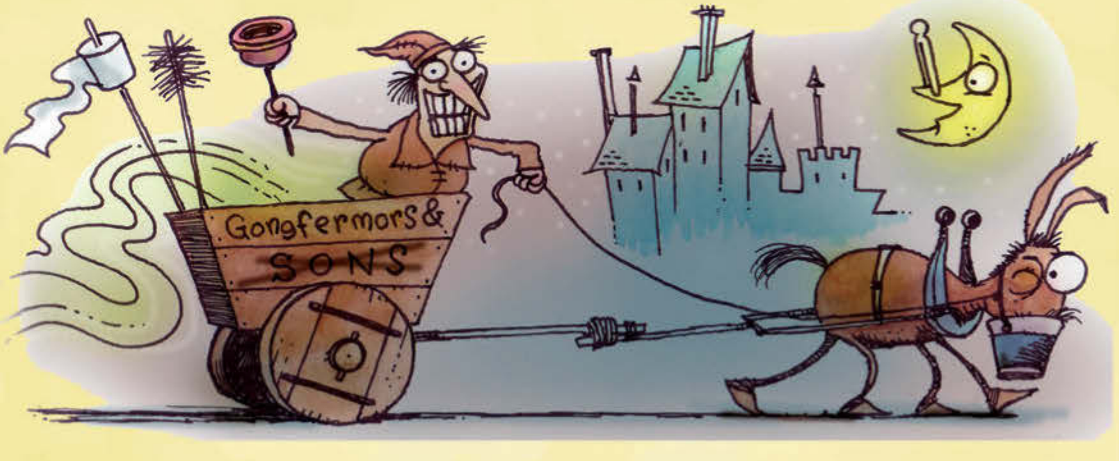
Some kings and queens decided that it was more comfortable to use something called a close stool. This royal toilet was basically a bucket

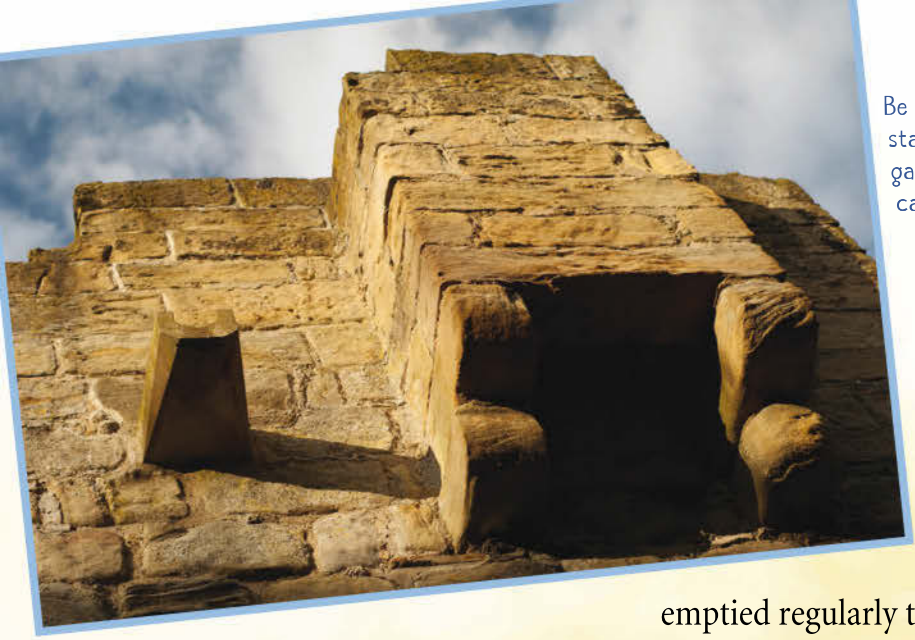
Look out! Loaded guzunder!

Chamber pots, a personal toilet, were often kept under the bed, for night use.

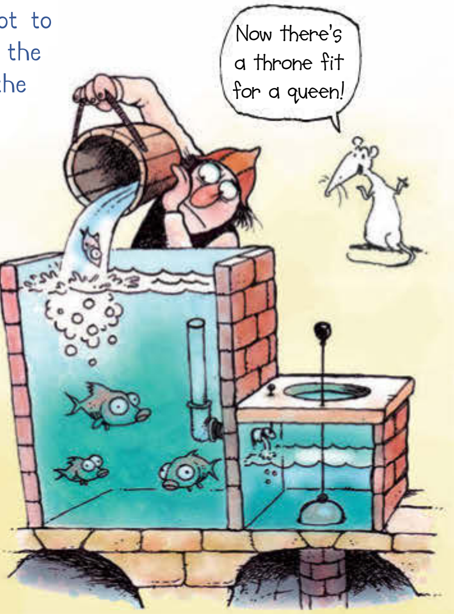
Why do they call chamber pots "guzunders?"


Because it "goes under" the bed!

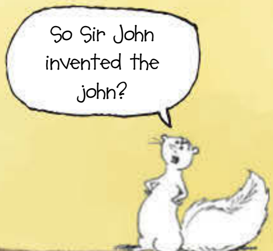




Be careful not to stand under the garderobe—the castle toilet.


Now there's a throne fit for a queen!

The first flush toilet, 1596


So Sir John invented the john?

inside a fancy seat covered in padded velvet. Well, this was all very nice for the king, but someone had to empty the bucket now and then. And of course, no self-respecting monarch would wipe his own bottom. He had a servant to do that.

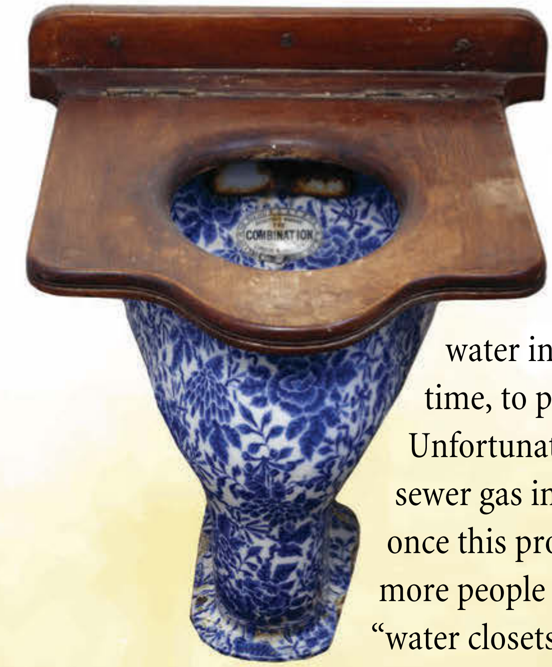
The Royal Flush

In 1596, Sir John Harington, a godson of Queen Elizabeth I, thought there must be a better way. So he invented the first flush toilet. Not since the toilets of Rome had going to the bathroom been so clean. With the pull of a handle, water from a basin flushed out the toilet bowl and washed the contents through a drain pipe into a holding tank below. The delighted queen had Harington's toilet installed in her castle. Of course, the tank had to be emptied regularly to keep it from smelling.

According to Harington's instructions, "At noon and night, empty it and leave it half a foot deep in fair water. And this being done . . . your worst privy will be as your best chamber." (*Privy* means "private" and is an old-fashioned name for a toilet.) But Harington's toilet didn't catch on. Some people even laughed at it. They preferred their close stools and cesspits.

A fancy box over a bucket makes a close stool fit for a king.

Then why don't we call it a Harington?



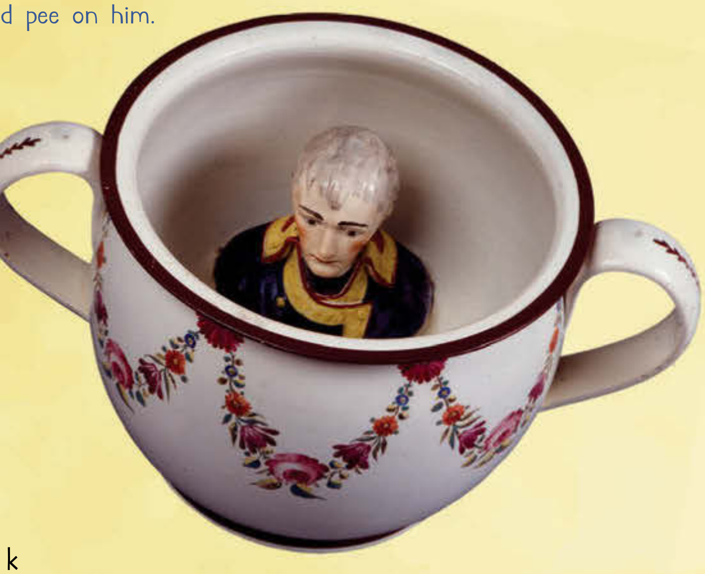
Fancy designs helped make indoor toilets popular.

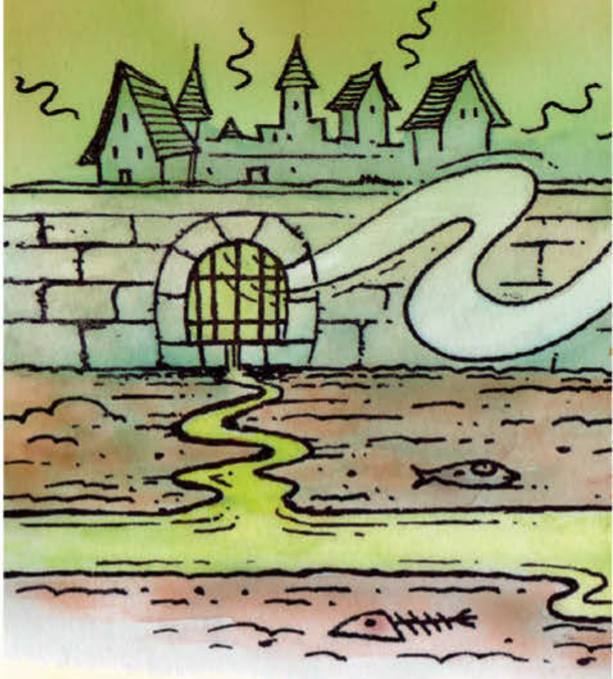
The Great Stink

In the 1770s, inventors rediscovered the flush toilet. A new design kept water in the bowl all the time, to prevent bad smells. Unfortunately, it still let stinky sewer gas into the house. But once this problem was fixed, more people began to install "water closets" in their homes. Good news, right?

Not always. As the big cities of Europe got more and more crowded in the 1800s, waste became a huge problem. Flush toilets didn't help. Sewer pipes, when there were any, often emptied straight into the local river. In London, the flushes from thousands of new toilets ended up in the River Thames, London's main waterway and also the main source of drinking water. It smelled horrible, and the filthy, germ-filled water killed thousands of people.

When England was at war with France in the 1800s, the British made chamber pots with the head of their enemy Napoleon inside, so they could pee on him.





The last straw came in the hot, dry summer of 1858. Water in the Thames was low and sluggish. In the heat, the toilet waste that fouled its waters began to stink so badly that many people fled the city. The "Great Stink" convinced the government that London needed a modern sewer system that took toilet waste away from the river. Completed in 1865, the new sewers at last allowed Londoners to flush their toilets without poisoning their drinking water.

Flush toilets kept improving, until they took the shape we know today. They work pretty well, but engineers are always trying to improve them. New toilets use less water—or none at all—and recycle waste in safe ways. Clean, earth-friendly toilets are an important part of a better future for all the world's people. Because however much the world changes, everybody's gotta go.

On a boat, the toilet is called the head.

How Does Your Toilet Work?

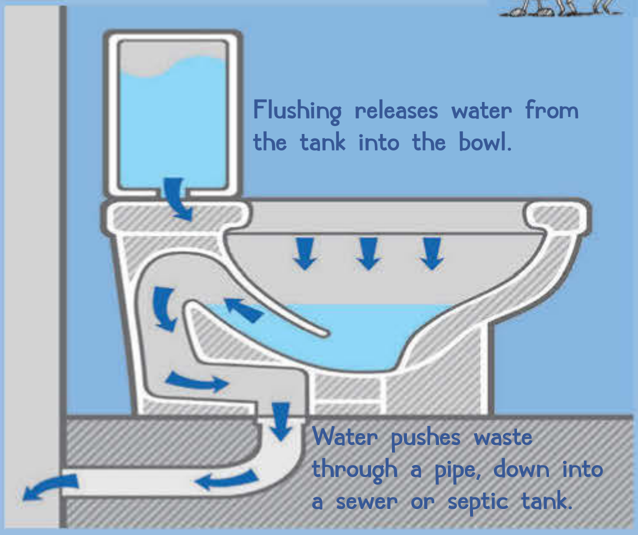
The standard flush toilet has a tank of water on the back, and a water-filled bowl where pee and poop go.

When you're done, a handle or button opens a flap that lets water out of the back tank.

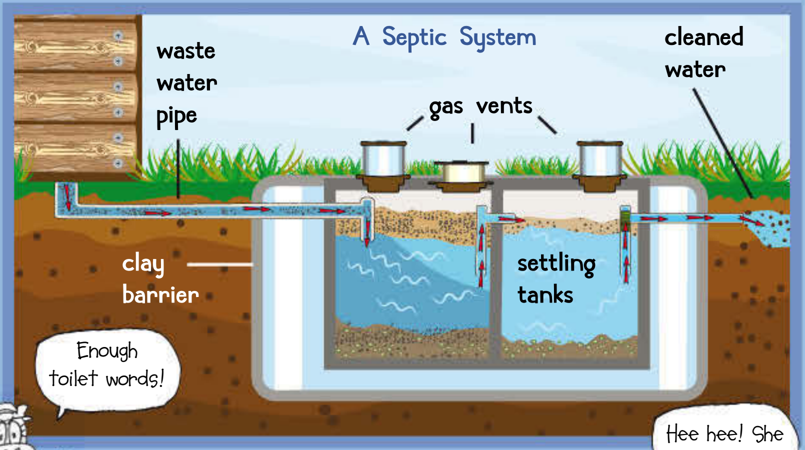
Water rushes down into the bowl, pushing the waste through an S-shaped pipe and out to the sewer or septic tank. The S loop traps fresh water in the bowl so sewer gas doesn't escape back up into the house.

If your house is connected to a city sewer, your flush flows down into a big tunnel under the street. Then it goes to a sewage treatment plant.

If you have a septic tank, the flush goes into a big box buried underground. Solid waste settles out to be digested by bacteria. Water is filtered by sand and returns to the ground. If you have a composting toilet, the waste goes into a composter and is broken down by bacteria.


Flushing releases water from the tank into the bowl.
Water pushes waste through a pipe, down into a sewer or septic tank.

A bendy pipe keeps water in the bowl and stops sewer gas from coming back up.


A Septic System
waste water pipe
cleaned water
gas vents
clay barrier
settling tanks

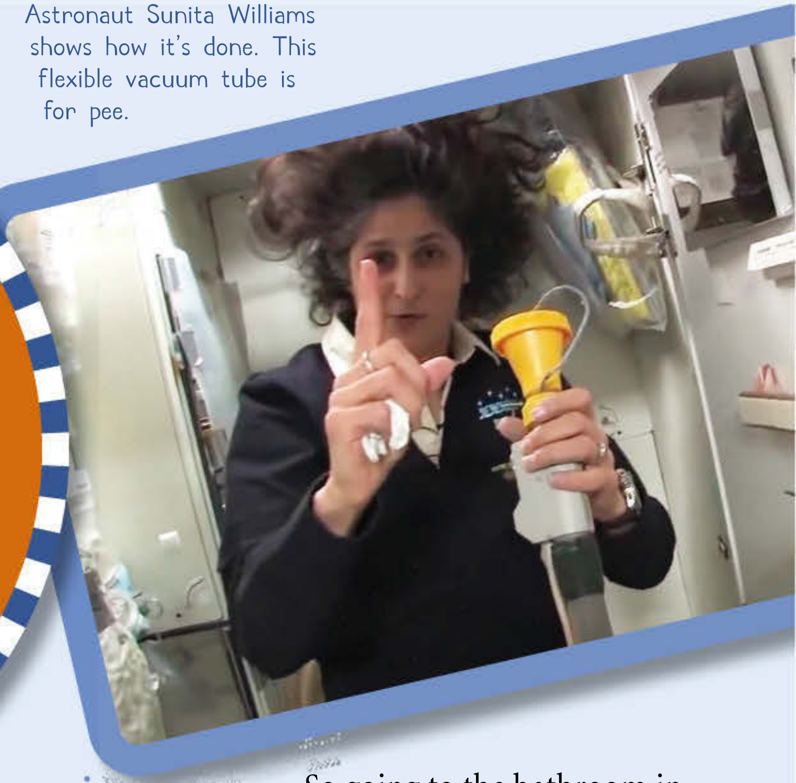
Enough toilet words!

Hee hee! She said toilet!

How Do Astronauts

Very carefully . . .

Uh oh. Gotta go. Clamps on? Check. Vacuum on? Check. When you're done, clean funnel with wipes. Check. Where on Earth are you? You're not on Earth, but circling high above it aboard the International Space Station.



Astronaut Sunita Williams shows how it's done. This flexible vacuum tube is for pee.

On Earth, gravity pulls pee and poop into the toilet and keeps it there. When you flush, gravity pulls waste through the pipes to the sewer. But in space, things float around. The motion of the Space Station as it orbits Earth makes it feel like there's no gravity on board. "In space, if you had a regular household toilet, the water would just float around and eventually float out," says NASA astronaut Randy Bresnik. Yuck!

So going to the bathroom in space takes a special kind of toilet. In space toilets, gentle vacuums do the work of gravity. Flowing air sucks everything into the toilet and holds it there.

To pee, astronauts use a simple funnel attached to a hose. There are different tops for men and women. Astronauts poop into a metal toilet with a very small opening, the size of a baseball. Vacuum suction helps things along there too.

Disposable bags line the sit-down toilet. When astronauts finish, they

Yet another reason robots make the best astronauts!

Go to the Bathroom?

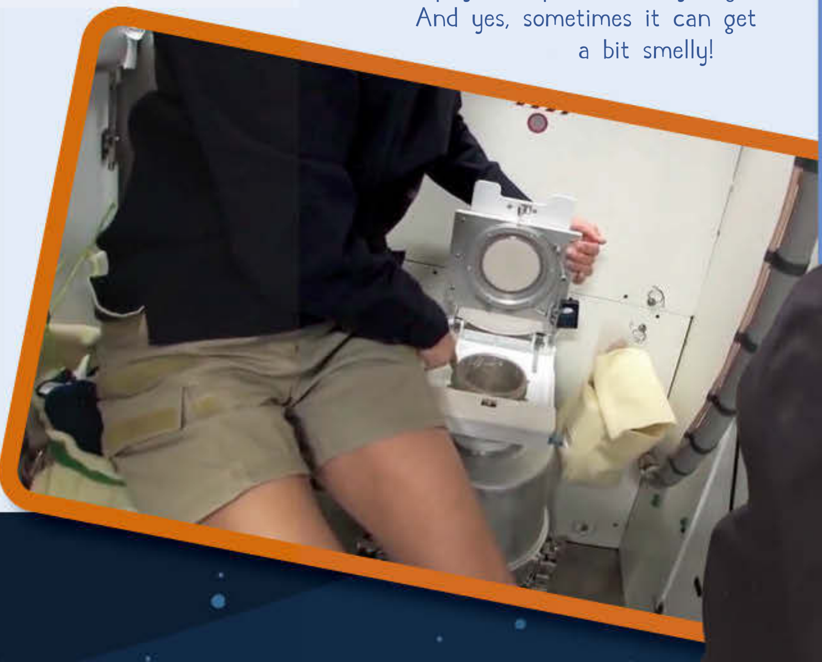
by Kirsten W. Larson

close the bag and push it through a hole into a storage container—no flushing required. The Space Station has its own water treatment plant, where dirty water, including pee, is cleaned and recycled. Bags of poop go out with the trash. They burn up with the rest of the trash when they hit Earth's atmosphere.

Because going to the bathroom is quite different in space, astronauts get some extra potty training. In practice bathrooms on Earth, they learn how to work the space toilets and how to sit correctly over the small hole. Training helps to make these daily tasks easier, leaving more time for science.

But some things can only be learned in space. "When you go to the bathroom in space, you have to use your elbows and your feet to hold yourself in the right position because there's no gravity," says Scott Weinstein, who trains astronauts. As he notes, "On Earth, it's easy to eat, go to the bathroom, and sleep because gravity helps out. In space those basic things take a little bit more time and effort."

This small sit-down potty is for "number two." Bars and straps keep you in place while you go. And yes, sometimes it can get a bit smelly!



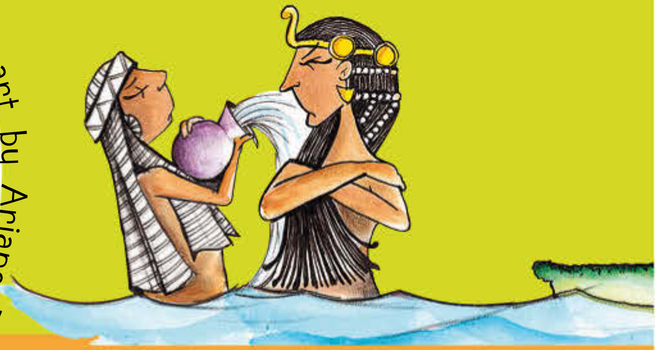
Getting the Dirt Off

by Meg Dorman, art by Ariane Elsammak

Do you like a long bath with bubbles and toys, or a quick shower? Throughout history, people have found many different ways to keep clean. Often, a bath was a swim in a handy river or lake. In ancient Egypt or Rome, you might have bathed every day (although not alone). But people have always found a way get clean.

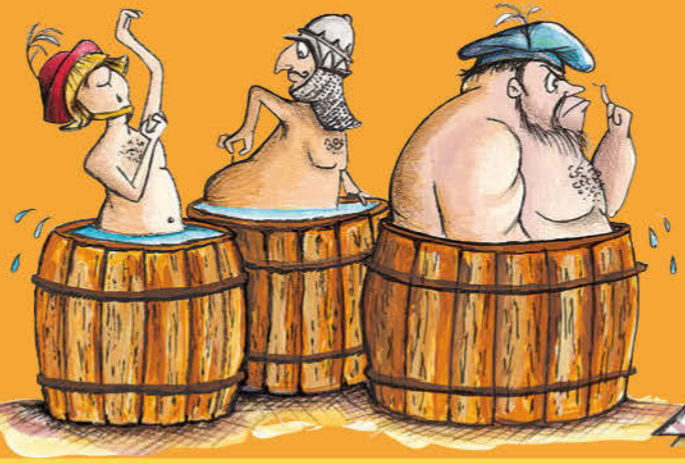
Bathe like an Egyptian

Bathing began as a simple operation—just rinse off in a nearby river. Ancient Egyptians bathed regularly in the Nile. (Of course, they had to keep an eye out for crocodiles.)



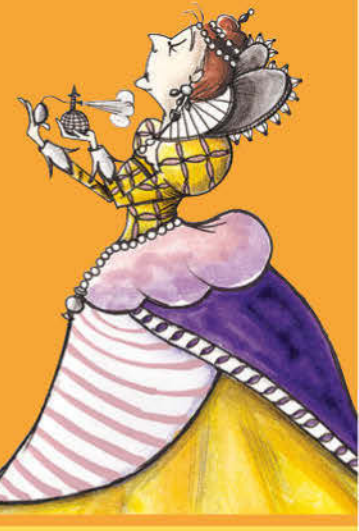
Look Out for Splinters!

In the Middle Ages, your bathtub might have been a wooden barrel lined with canvas, to prevent splinters. Bath-houses were also popular. But when plague came in the 1340s, public bathhouses were shut down because people feared the spread of disease.



Queen of Unclean?

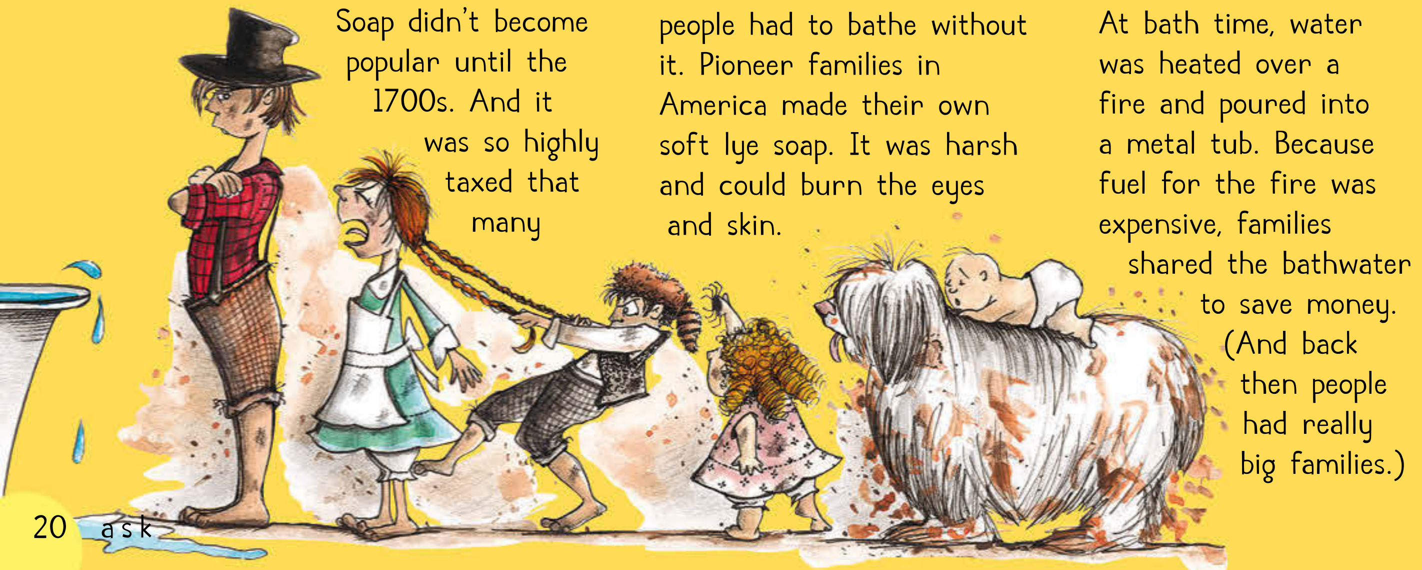
Even in the Middle Ages, people bathed regularly once a week or so, for good health. Mostly.



Share the Water

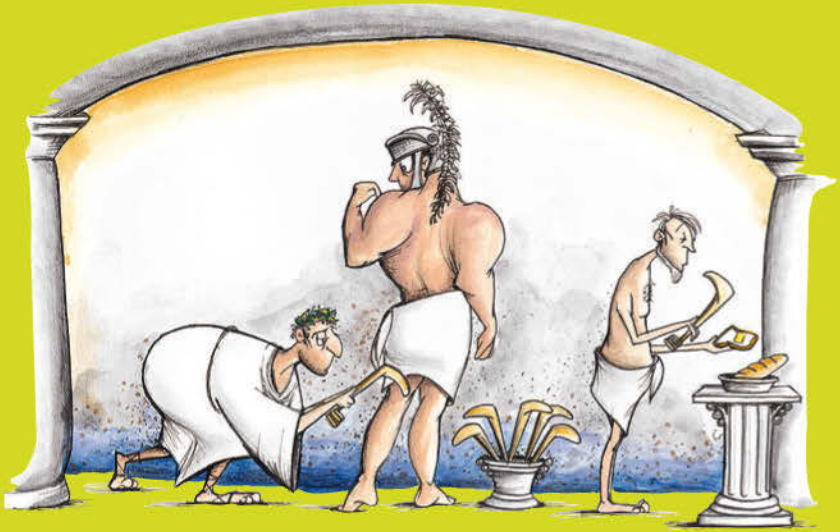
Soap didn't become popular until the 1700s. And it was so highly taxed that many people had to bathe without it. Pioneer families in America made their own soft lye soap. It was harsh and could burn the eyes and skin.

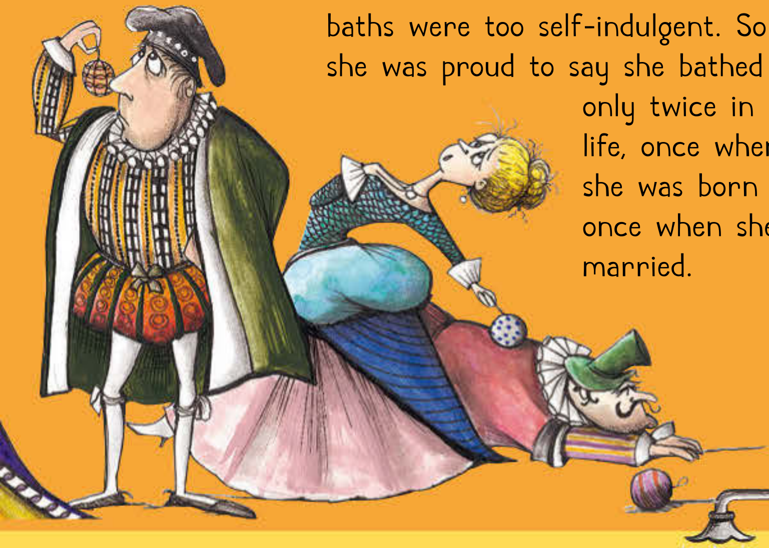
At bath time, water was heated over a fire and poured into a metal tub. Because fuel for the fire was expensive, families shared the bathwater to save money. (And back then people had really big families.)



You'll Never Bathe Alone

The Romans built big public bath houses where they would hang out, play sports, soak in hot and cold pools, and talk with their friends. Everyone bathed, rich and poor. But they didn't use soap. After exercising, bathers rubbed themselves with sand and oil. Then the oily mess was scraped away with a strigil—a curved stick—for that refreshing, scraped-clean feeling. Aah!



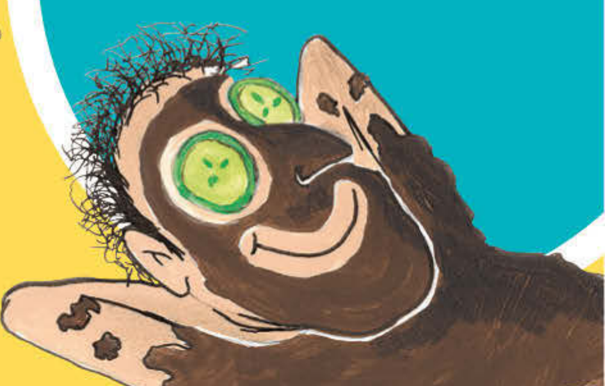


One famous exception was Queen Isabella of Castile. She believed that baths were too self-indulgent. So she was proud to say she bathed only twice in her life, once when she was born and once when she married.

In the 1500s, Queen Elizabeth of England was known for her sensitive nose. She traveled with her own bathtub and used lots of perfume to cover the odors of others. Many people carried pomanders, small boxes of sweet-smelling spices, to ward off disease—and to cover the smells of those who didn't like bathing.

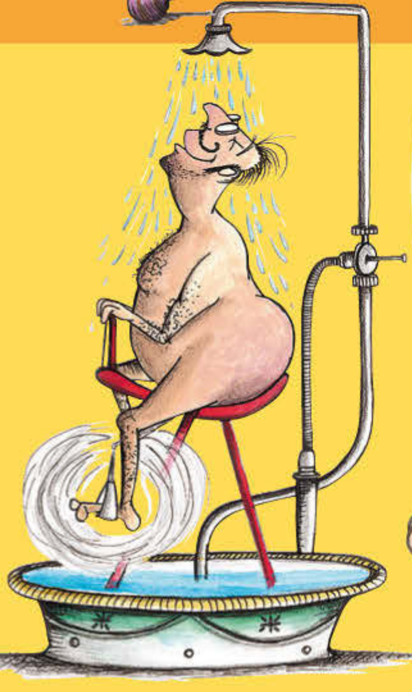
Just Roll in the Mud

And for the ultimate in getting clean, some people bathe in—mud! It feels good, and the drying mud draws out oil. (But it sure is hard to keep your towels clean.)



Pedal Faster!

Some people prefer showers to baths. But showers weren't practical until running water was pumped into homes. One inventor tried to solve the problem with a bicycle-powered shower. The faster you pedaled, the cleaner you got.

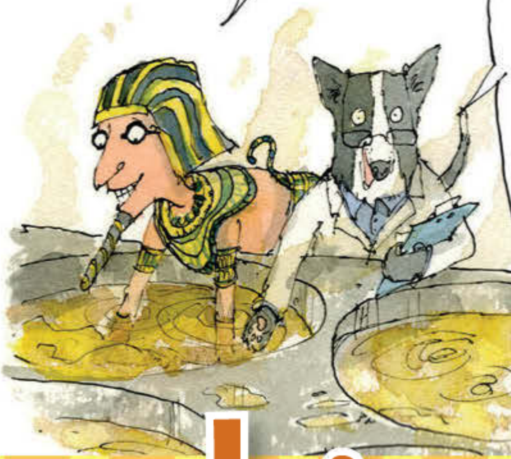


Liquid

What would you give for a bucket of pee? You might be surprised—pee is full of useful stuff.

Urine (or pee) is your body's way of getting rid of waste chemicals. There are more than 3,000 different chemicals in pee—all made by your body.

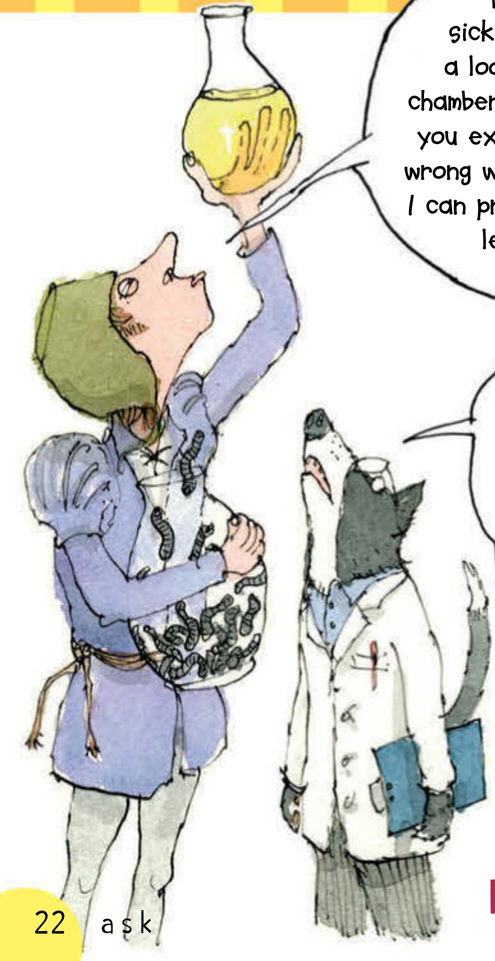
Egypt, 1000 BCE



I'll trade you some gloves for ten buckets of good pee! Yep, any tanner will tell you, just soak a tough old hide in a nice vat of pee, and soon you've got good, soft leather.

When pee sits around in air, one of its ingredients, called urea, breaks down into ammonia, a powerful cleaning chemical. Ammonia binds to dirt and fat, so it's good for washing and softening leather.

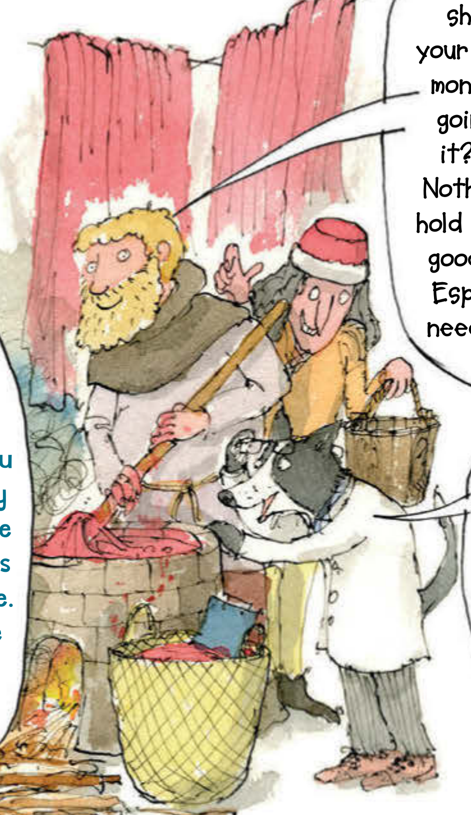
Doctor, 1460



Feeling sick? I'll take a look at your chamber pot and tell you exactly what's wrong with you. Then I can prescribe some leeches!

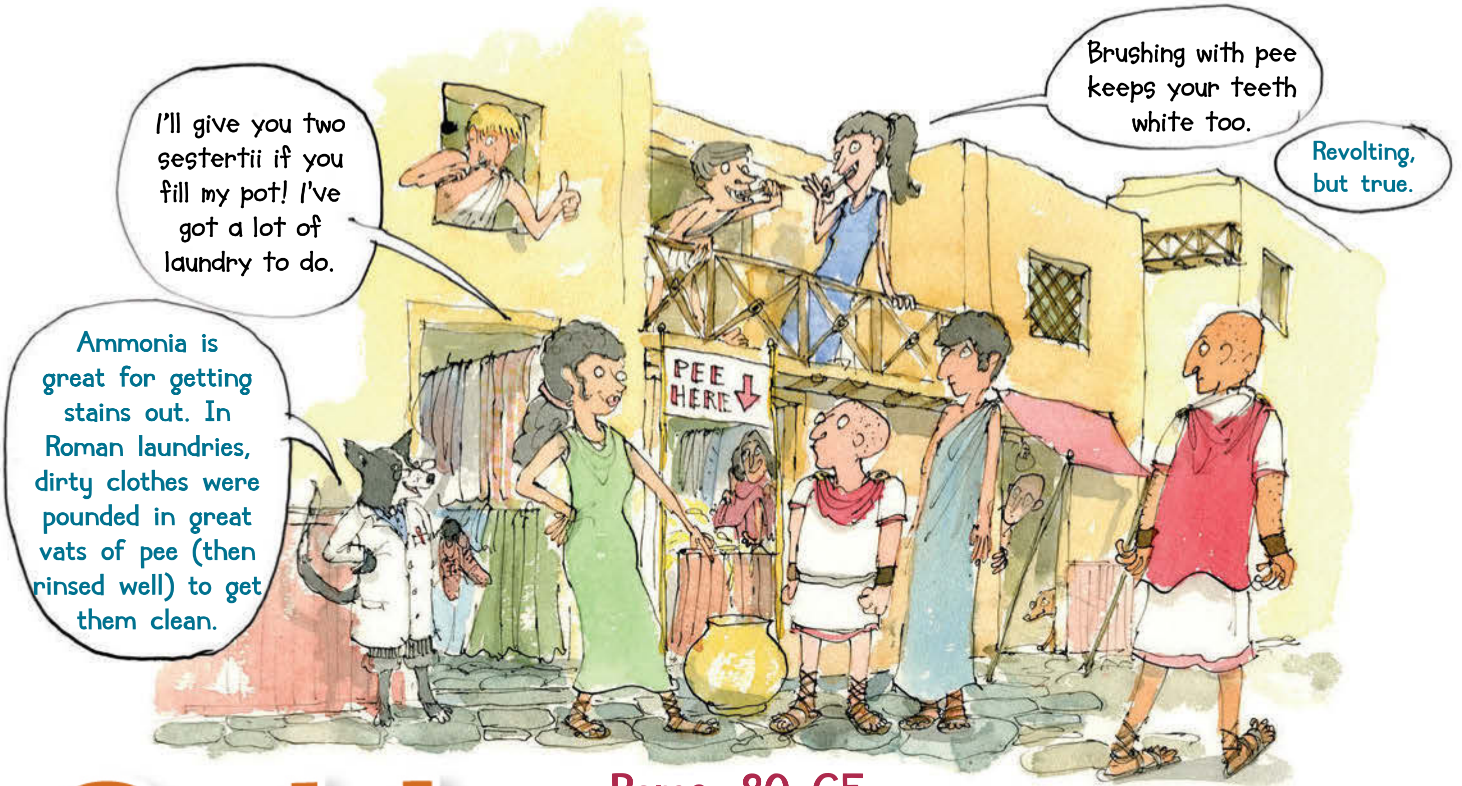
Ancient doctors often looked at a patient's urine to spot illnesses. In fact, doctors still do. If you are ill or your body is not working quite right, the chemicals in your pee change. Diabetes can make urine smell sweet, and infections can make it cloudy.

Dyer, 1580



I'll give you three shillings for all your fresh pee this month! What am I going to do with it? Color cloth! Nothing makes dye hold its color like a good soak in pee. Especially red—need a lot of pee for red.

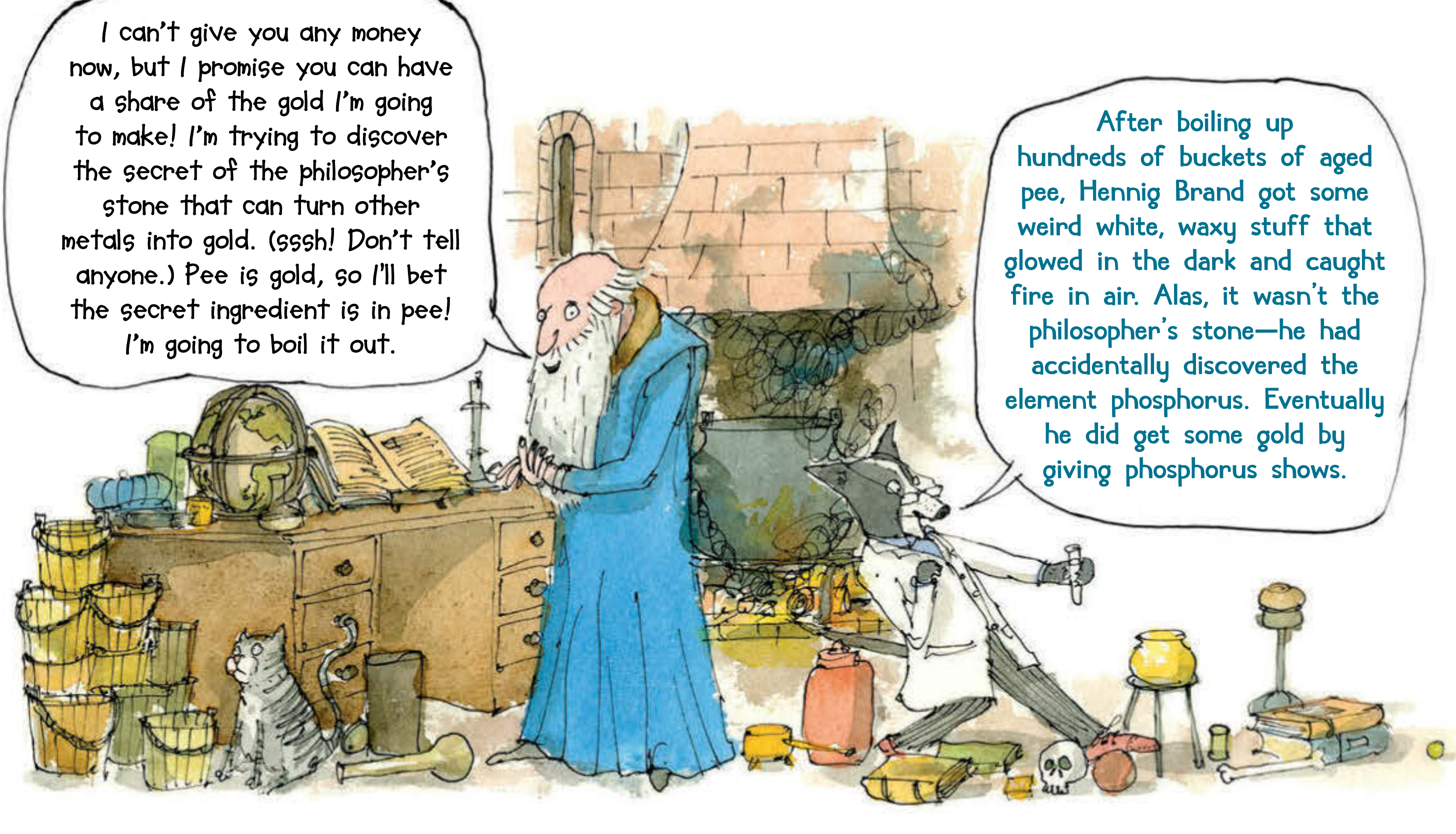
It's that ammonia again—it makes a great dye fixer, binding the color to the fabric so it won't wash out.


I'll give you two sestertii if you fill my pot! I've got a lot of laundry to do.
Brushing with pee keeps your teeth white too.
Revolting, but true.
Ammonia is great for getting stains out. In Roman laundries, dirty clothes were pounded in great vats of pee (then rinsed well) to get them clean.
PEE HERE

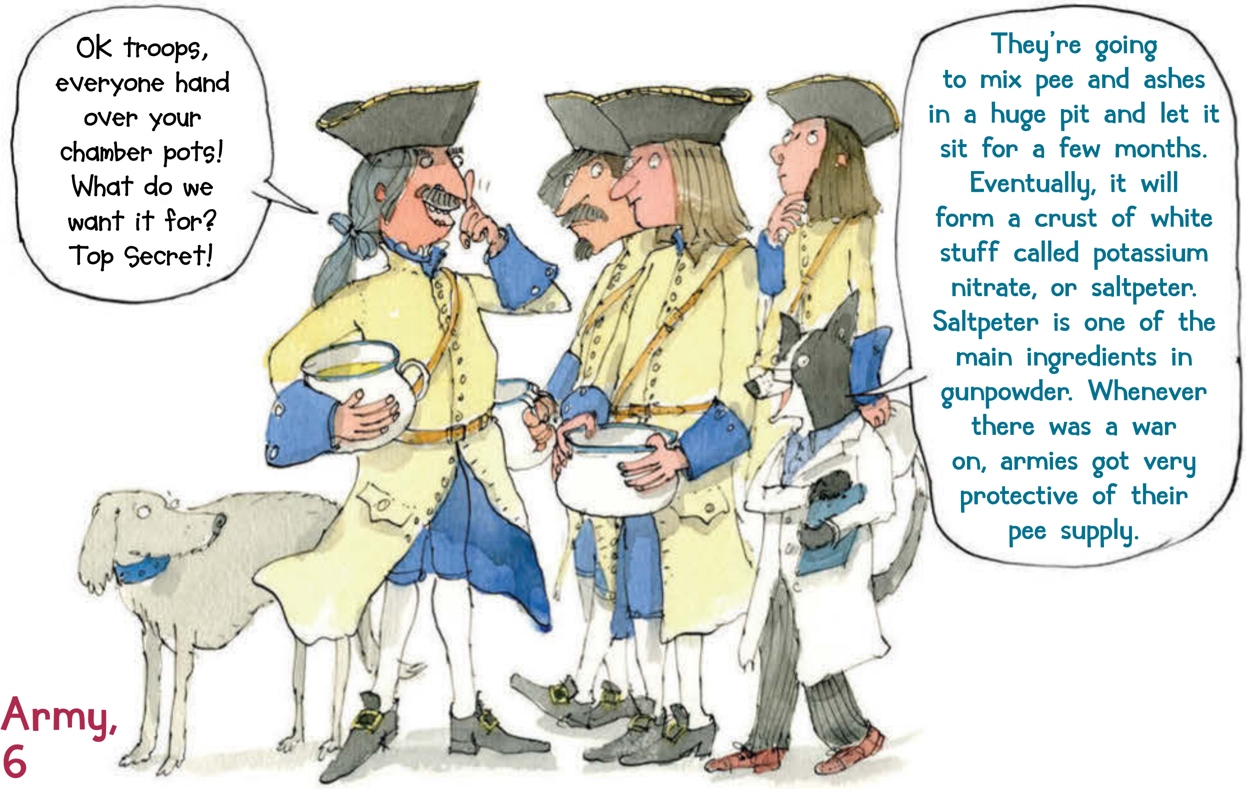
Rome, 80 CE

Gold

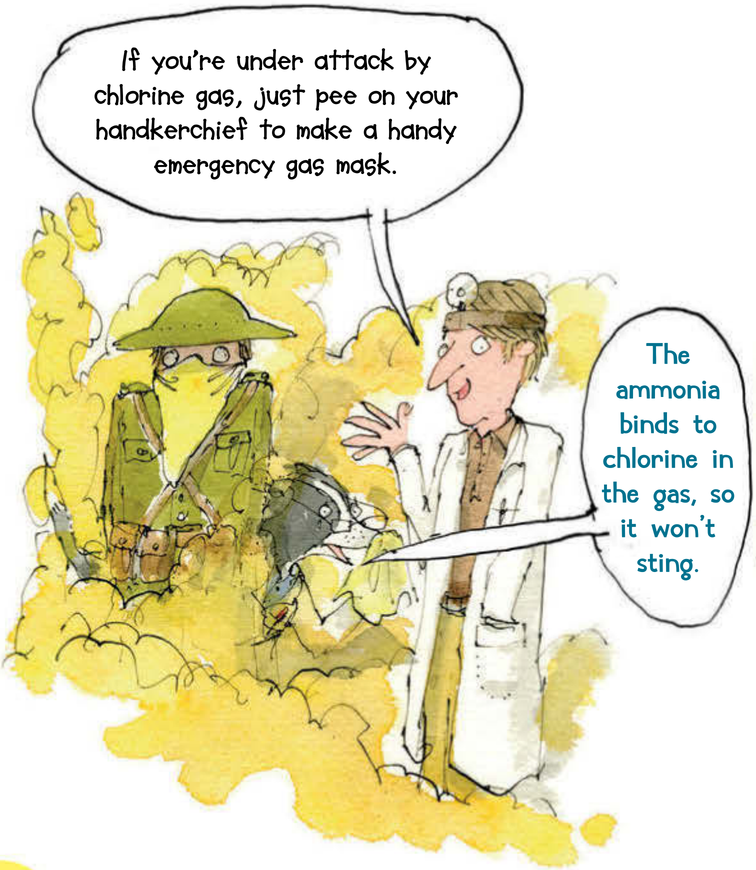
art by Rupert van Wyk


I can't give you any money now, but I promise you can have a share of the gold I'm going to make! I'm trying to discover the secret of the philosopher's stone that can turn other metals into gold. (sssh! Don't tell anyone.) Pee is gold, so I'll bet the secret ingredient is in pee! I'm going to boil it out.
After boiling up hundreds of buckets of aged pee, Hennig Brand got some weird white, waxy stuff that glowed in the dark and caught fire in air. Alas, it wasn't the philosopher's stone—he had accidentally discovered the element phosphorus. Eventually he did get some gold by giving phosphorus shows.

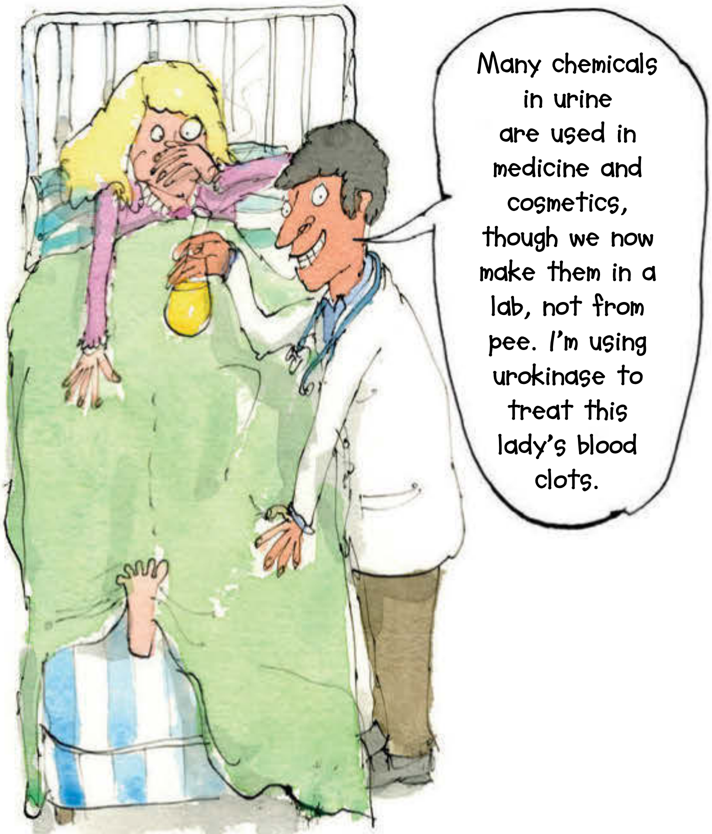
Hennig Brand, Alchemist, 1669


OK troops, everyone hand over your chamber pots! What do we want it for? Top Secret!
They're going to mix pee and ashes in a huge pit and let it sit for a few months. Eventually, it will form a crust of white stuff called potassium nitrate, or saltpeter. Saltpeter is one of the main ingredients in gunpowder. Whenever there was a war on, armies got very protective of their pee supply.

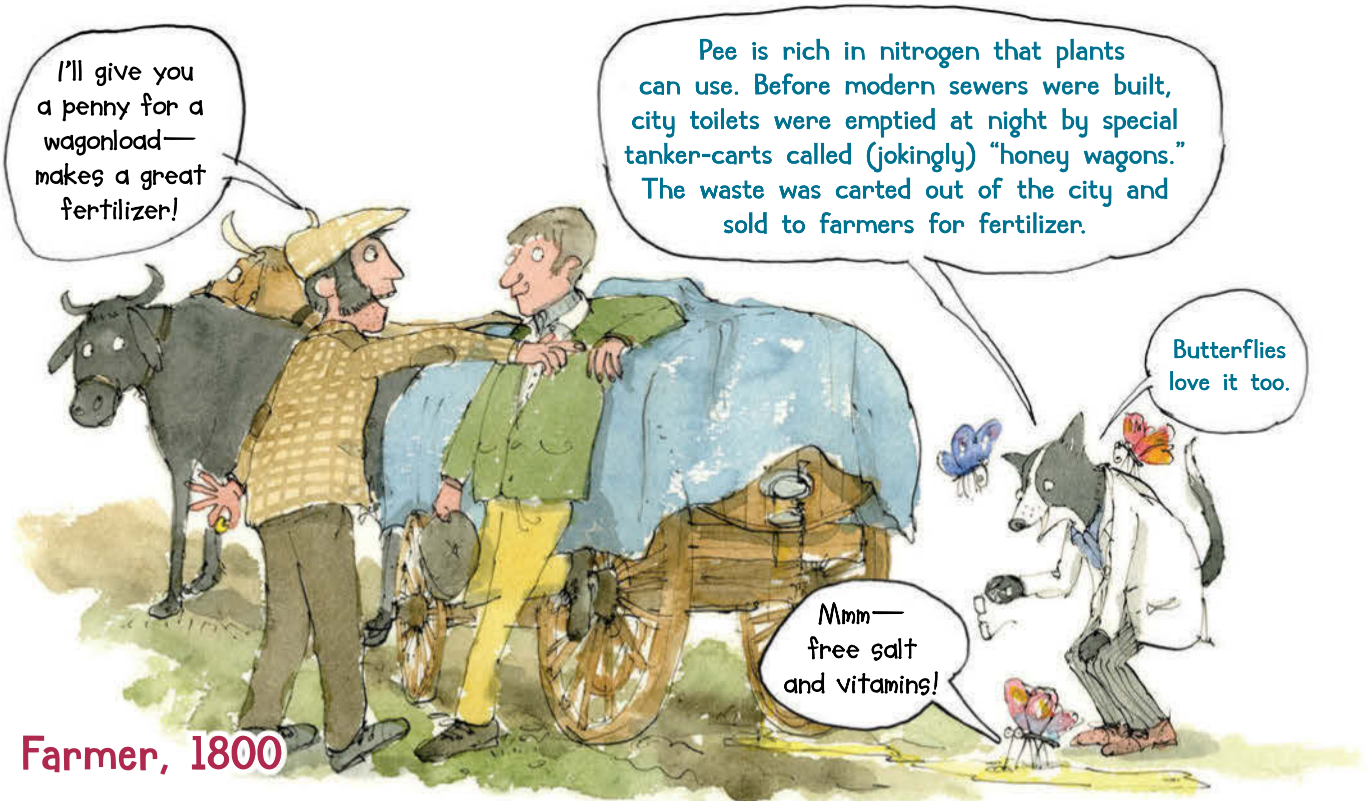
French Army, 1776


If you're under attack by chlorine gas, just pee on your handkerchief to make a handy emergency gas mask.
The ammonia binds to chlorine in the gas, so it won't sting.

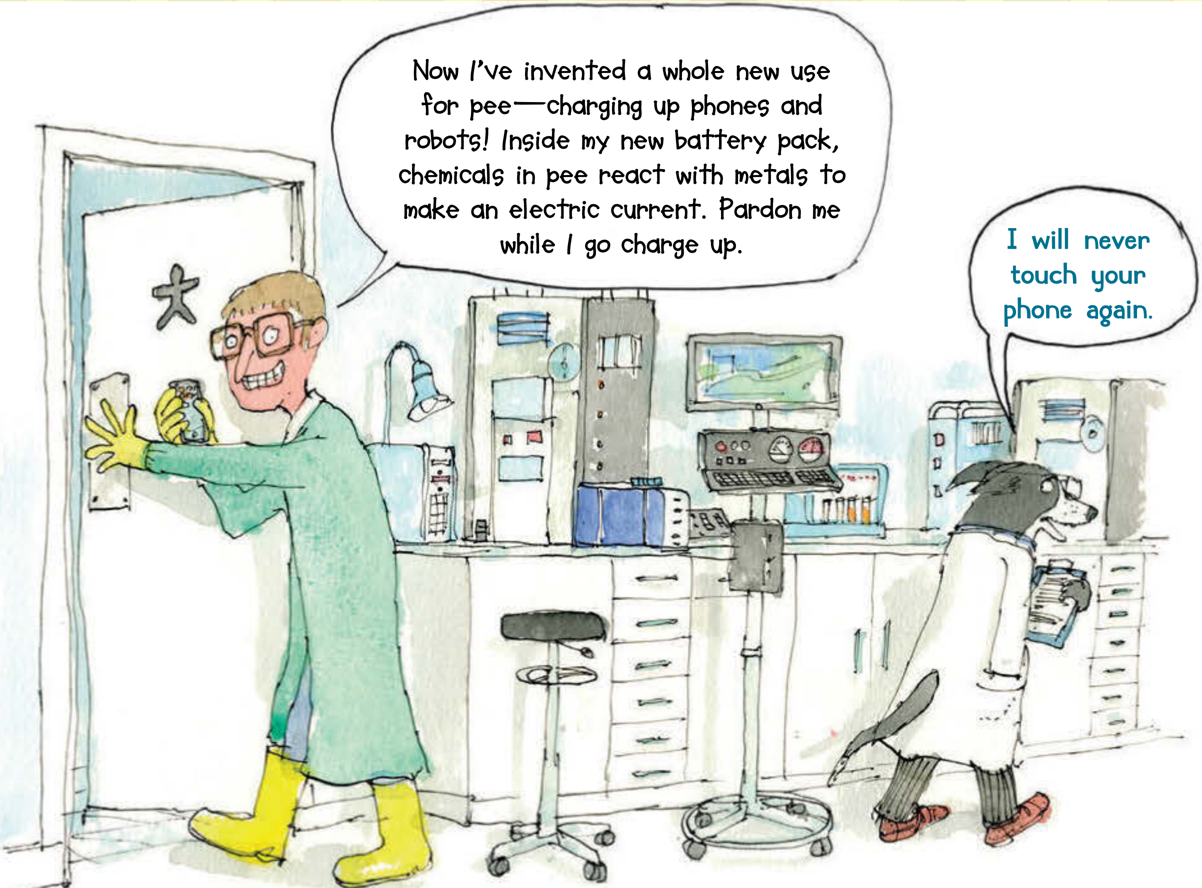
World War I, 1917


Many chemicals in urine are used in medicine and cosmetics, though we now make them in a lab, not from pee. I'm using urokinase to treat this lady's blood clots.

Doctor, 1930


I'll give you a penny for a wagonload—makes a great fertilizer!
Pee is rich in nitrogen that plants can use. Before modern sewers were built, city toilets were emptied at night by special tanker-carts called (jokingly) "honey wagons." The waste was carted out of the city and sold to farmers for fertilizer.
Butterflies love it too.
Mmm—free salt and vitamins!

Farmer, 1800


Now I've invented a whole new use for pee—charging up phones and robots! Inside my new battery pack, chemicals in pee react with metals to make an electric current. Pardon me while I go charge up.
I will never touch your phone again.

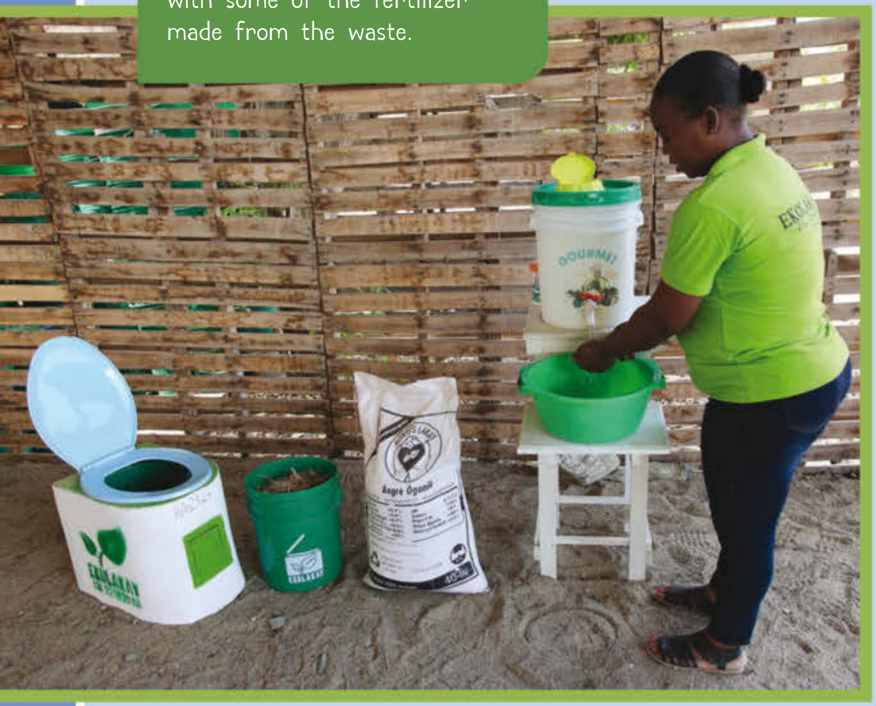
Cell Phone Lab, 2013

art by Dave Clark

A NEW WAY TO GO?

Do you know what holiday falls on November 19? World Toilet Day, of course! How do you plan to celebrate?

Have you thanked your toilet today? Maybe take a moment to appreciate this useful appliance. Unfortunately, many people around the globe do not have good toilets. World Toilet Day started in 2001 to draw attention to the problem. Since then, inventors around the world have been hard at work on designs for better toilets that are clean, cheap, earth-friendly, and work without running water or electricity. The goal is clean toilets for all.



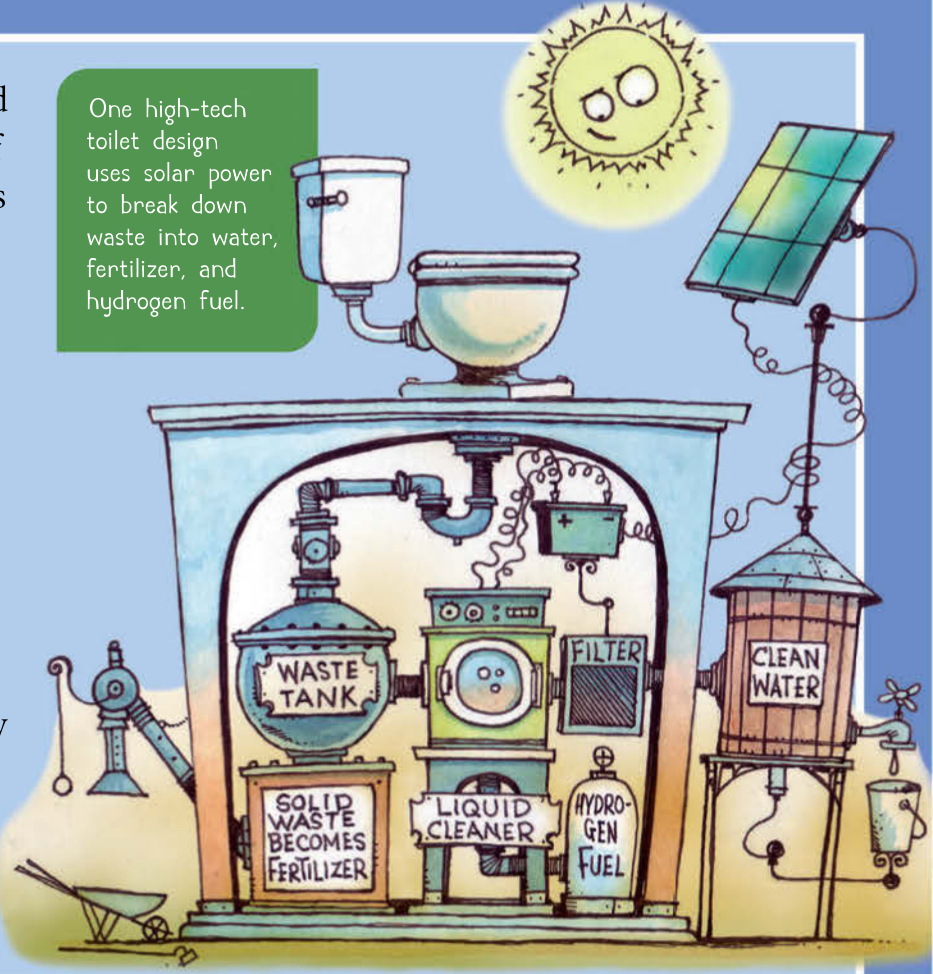
An EkoLakay composting toilet, with some of the fertilizer made from the waste.

A Waterless Flush

Why do so many people live without good toilets? One problem is water. Traditional toilets use water to flush the waste away. But lots of places don't have a lot of water to spare. And if there's no sewer system or water treatment plant, the flushes might go into rivers or onto fields. For almost half of the world's population, flush toilets are just not practical.

Composting toilets might be a good solution. They do not need water, so they're good for areas that are dry or don't have sewers.

Haiti's EkoLakay toilets look like a normal toilet. When you use one, pee and poop fall into separate containers.


One high-tech toilet design uses solar power to break down waste into water, fertilizer, and hydrogen fuel.

A scoop of peanut shells or shredded sugar cane stalks is added instead of flushing. This stops smells and helps microbes break down the waste.

Full buckets are picked up by a truck and taken to a central composting shed. The poop is mixed with plant scraps. Helpful bacteria digest the mix. The heat of the compost pile kills germs and parasites. In about six months, it turns into a rich, clean fertilizer that farmers buy to help their crops.

Each house pays a small monthly collection fee. This money, along with the profits from selling the compost, helps fund the toilets, and provides much-needed jobs.

In Kenya, users can pay a penny to use a Fresh Life composting toilet stall. Waste goes into a bucket and then to a composting site. Some gets turned into fertilizer. Some waste is burned to make electricity. And some is fed to fly larvae, which are sold for chicken feed.

New Old Ideas

A pit toilet is the oldest and most basic toilet of all—a hole in the ground, maybe with an outhouse over it. This is simple, but not very sanitary. Germs that cause cholera and other diseases can escape into the air and seep into water. But replacing the plain pit with a septic tank is a big improvement. Septic pits are lined with plastic or clay, to stop germs. Solids settle out and are digested by good bacteria at the bottom. Liquids pass through a sand or charcoal filter, and then return to the soil.

This one looks just right for me!
HIP-O-POTTY

Tiger Toilets

Some toilets get help from an unexpected partner—a kind of earthworm known as tiger worms. These worms love to eat rotting garbage and poop. Under a tiger toilet is a box with a screen in the middle. Solid waste stays in the top

Tiger worms at work

of the box, where the worms live. Liquid flows through small holes into a sand filter, or into a drain. The worms digest the waste into water, carbon dioxide, and worm castings, which are a great fertilizer.

Tiger toilets are simple to build and don't need water—though they can also work with a normal flush toilet. The worms are not smelly and don't need much tending. Just empty out the finished fertilizer every year or two. Tiger toilets are currently being tested in India, and are proving quite popular.

The Toilet Challenge

In 2011, billionaire Bill Gates sponsored the first Reinvent the Toilet Challenge. Inventors from around the world competed to come up with toilets that would work without running water or electricity, for 5 cents a day.

There were many creative designs. One used electricity from a solar panel to break down pee and poop into water, fertilizer, and hydrogen gas, which could be burned as fuel. Another toilet system baked poop into fuel blocks that were burned to treat the next batch of waste.

Some designs were too complicated and expensive to be practical. But the competition kicked off a new era of rethinking toilets.

My Favorite Toilet

What's the best toilet? One that is clean, simple, and pleasant to use. Many designs even make money, by turning waste into compost or fuel that can be sold, or collecting pennies from pay stalls.

The best toilet is also the one that best suits the needs and habits of its users. And that will be different everywhere. So the more designs, the better.

World Toilet, which sponsors World Toilet Day, hopes to get everyone talking about toilets. Clean, profitable, and water free—that's the way to go toward a better future.

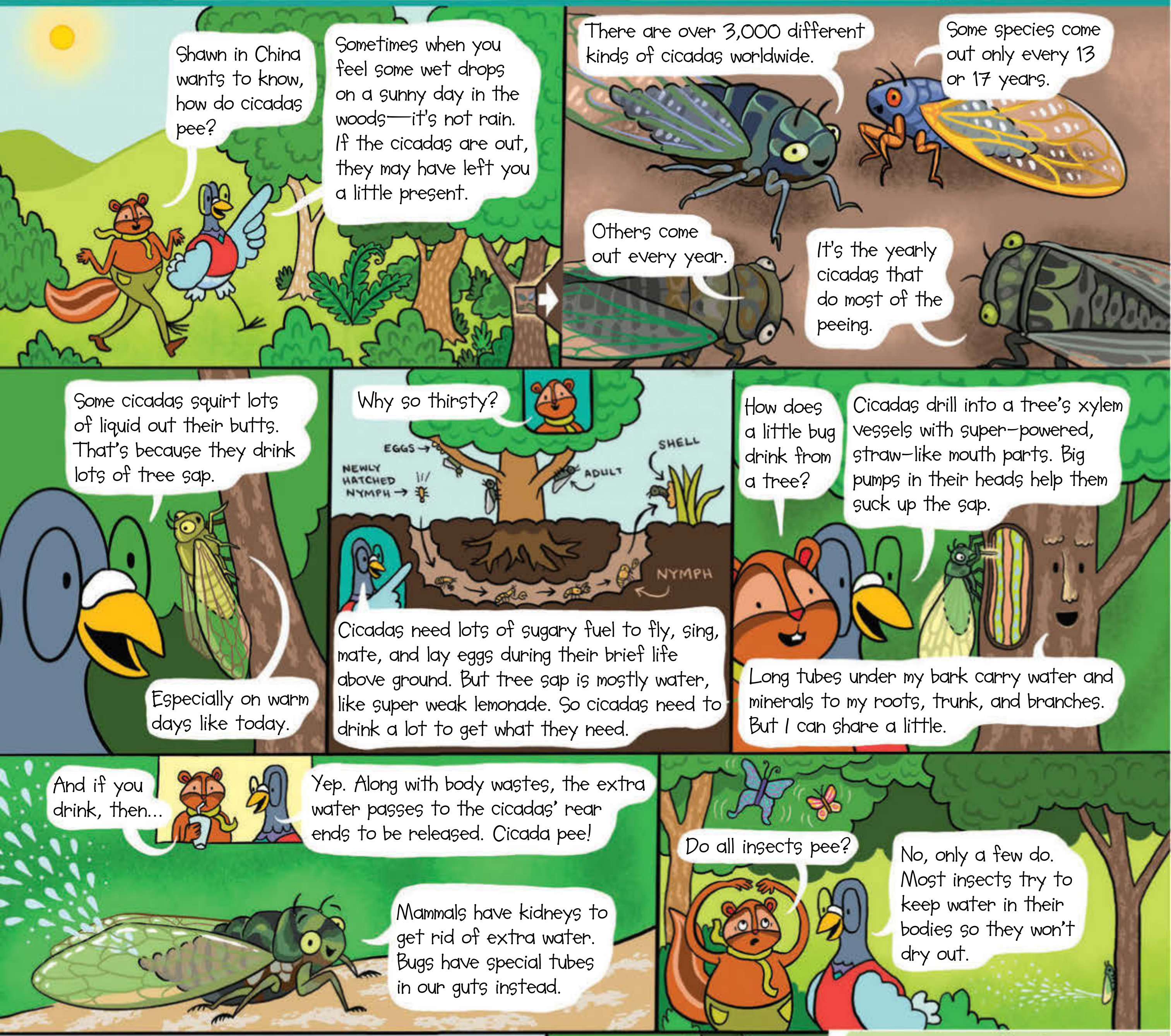
Fresh Life
Fresh Life
WATU WAZIMA
WATUWAZIMA 5
WATOTO 2

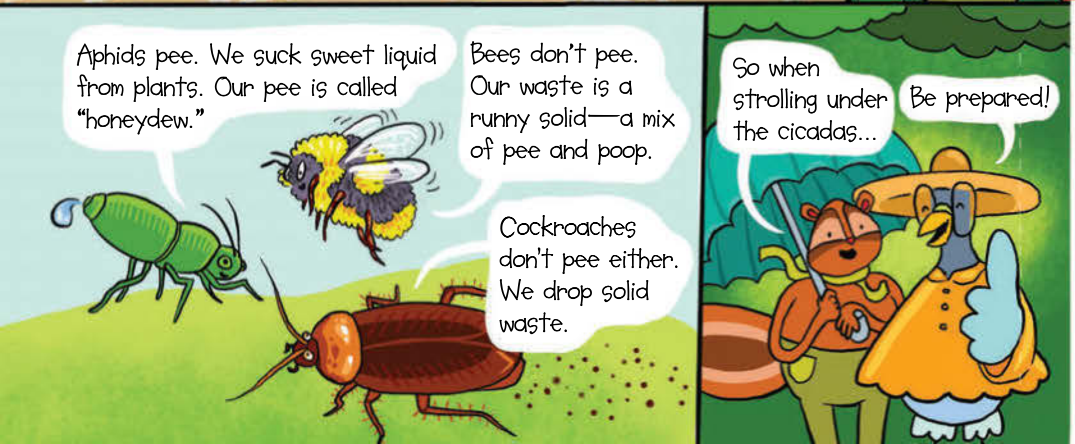
A Fresh Life toilet is good business. Owners make money by charging a fee to use it, and selling the waste to make fertilizer and electricity.

Ask Ask

WITH SAGE AND BRIAR

TEXT BY ELLEN R. BRAAF
ART BY MARNIE GALLOWAY


Shawn in China wants to know, how do cicadas pee?
Sometimes when you feel some wet drops on a sunny day in the woods—it's not rain. If the cicadas are out, they may have left you a little present.
There are over 3,000 different kinds of cicadas worldwide.
Some species come out only every 13 or 17 years.
Others come out every year.
It's the yearly cicadas that do most of the peeing.
Some cicadas squirt lots of liquid out their butts. That's because they drink lots of tree sap.
Especially on warm days like today.
Why so thirsty?
EGGS
NEWLY HATCHED NYMPH
ADULT
SHELL
NYMPH
Cicadas need lots of sugary fuel to fly, sing, mate, and lay eggs during their brief life above ground. But tree sap is mostly water, like super weak lemonade. So cicadas need to drink a lot to get what they need.
How does a little bug drink from a tree?
Cicadas drill into a tree's xylem vessels with super-powered, straw-like mouth parts. Big pumps in their heads help them suck up the sap.
Long tubes under my bark carry water and minerals to my roots, trunk, and branches. But I can share a little.
And if you drink, then...
Yep. Along with body wastes, the extra water passes to the cicadas' rear ends to be released. Cicada pee!
Mammals have kidneys to get rid of extra water. Bugs have special tubes in our guts instead.
Do all insects pee?
No, only a few do. Most insects try to keep water in their bodies so they won't dry out.


Aphids pee. We suck sweet liquid from plants. Our pee is called "honeydew."
Bees don't pee. Our waste is a runny solid—a mix of pee and poop.
Cockroaches don't pee either. We drop solid waste.
So when strolling under the cicadas...
Be prepared!

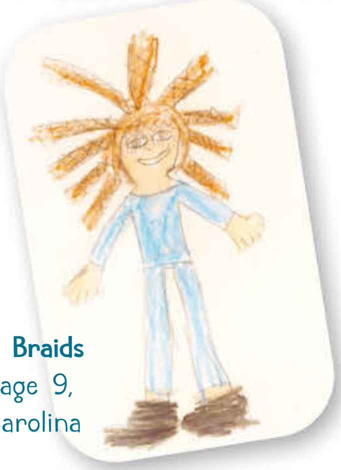
ASK US ANYTHING!

WRITE TO US AT:
ASK
1 EAST ERIE STREET
SUITE 525, PMB4136
CHICAGO, IL 60611
OR HAVE YOUR PARENT EMAIL
ASK@CRICKETMEDIA.COM

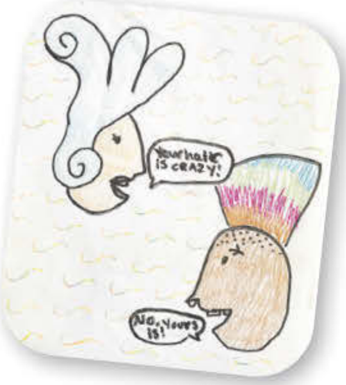
CONTEST and LETTERS

Send your letters to Ask, 1 East Erie Street, Suite 525, PMB4136, Chicago, IL 60611, or have your parent/guardian email us at ask@cricketmedia.com.

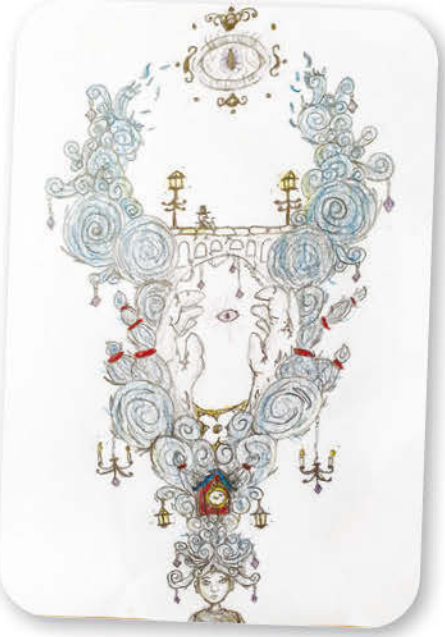
In our Nov/Dec issue we asked you to imagine a fantastic new hairstyle for yourself. We salute all you super stylists for shaking it up!



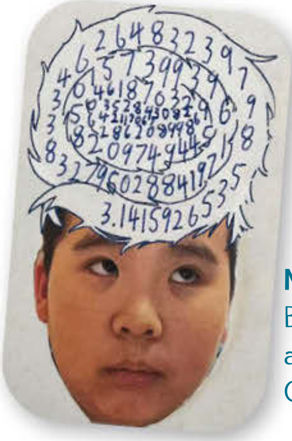
Me with Braids
Ella G., age 9,
North Carolina


Your hair is CRAZY!
No, Yours is!

Delia N.,
age 10



Dylan L., age 10,
New Jersey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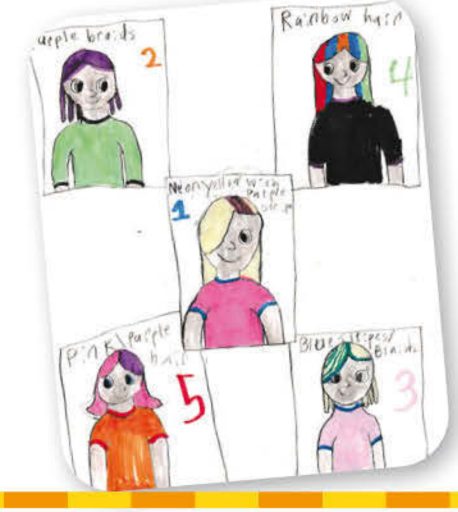
My Wig
Berry,
age 9,
China

Top Five Hairstyles For Me
Anna P., 10, Nebraska


urple braids
2
Rainbow hair
4
Neon yellow with purple stripe
1
Pink purple hair
5
Blue stripes/Braids
3

Dear Marvin,
Hi, what is your favorite food? I really like cheeseburgers. Do you know cows are really easy to prank? My favorite month is coming up, April! April 1 is THE BEST.

Bye! Sincerely,
Ben Z., California

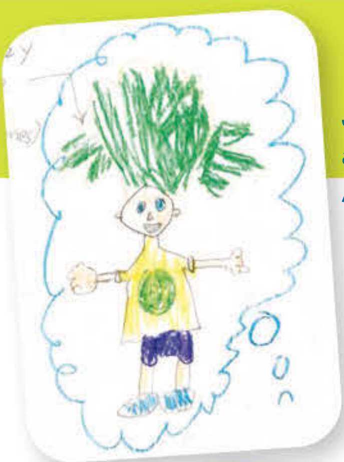
Dear Ben,
What kinds of pranks do cows like? Sneak some chocolate syrup into the milking pail and tell them they've started giving chocolate milk? April is the best! But it's too short. So I changed my calendar so April has 30 April 1sts. Most fun month ever!

Prankmaster Marvin

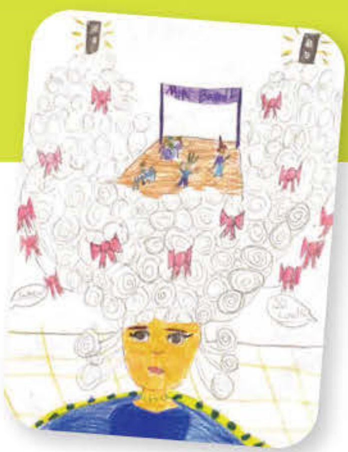
Dear *Ask,*
I've been reading your magazines for a year and I have one question. Where do you learn all your stuff?

Sery, age 10,
Kansas

Dear Sery,
Everywhere! We start at the library, read some books and

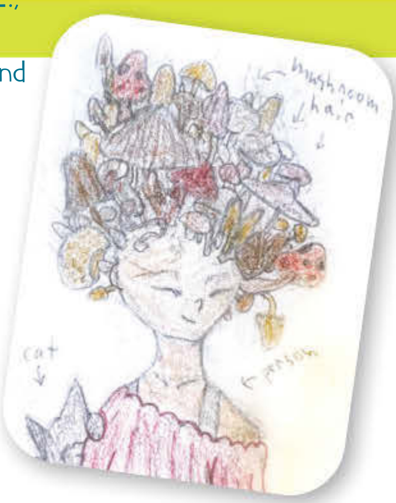


James B.,
age 8,
Arizona



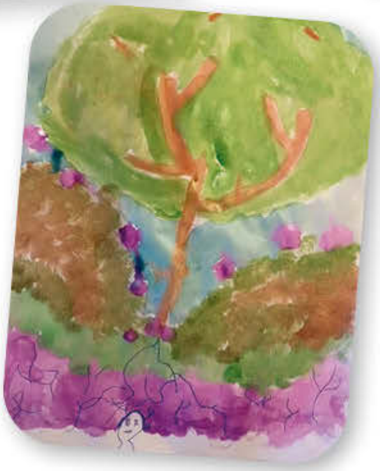
Fabiola B.,
age 10,
Connecticut

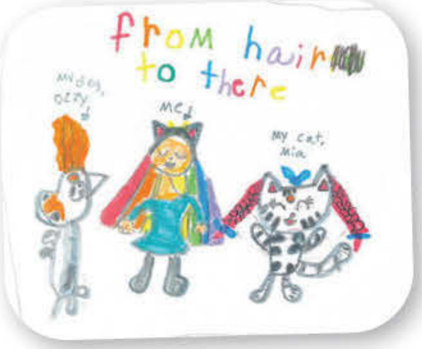
Fiona Z.,
age 11,
Maryland



mushroom hair
cat
person

Nature Hair
Everly,
age 8,
Colorado

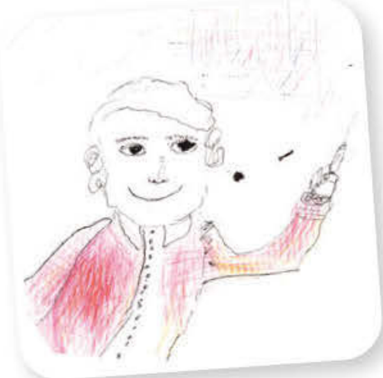




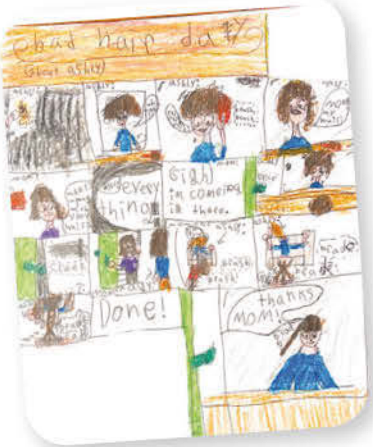
from hair to there
Midas, ozzy
me
my cat Mia

Eloise, age 8, Montana

Reagan B., age 9, Florida



The Man with the Wig
Jamyang,
age 7,
New York



bad hair day
Ashly!
every thing
sigh) im comeing in there.
Done!
thanks MOM!

Bad Hair Day
Ramona R., age 11,
California

science journals, ask some scientists, look online, watch experiment videos, listen to podcasts, and sometimes, go out and try things for ourselves. One thing we have learned, you never know where a question will take you. Find a thread, and pull!

See you in the stacks,
Bone Pony

Dear Marvin,
Pranks rule! I think Plush needs to take a vacation. On the Island of Pranks, that is! You should invent a robot that looks exactly like you, so you can pull pranks and blame it on the robot.

Long live pranks!
Pili G., Virginia

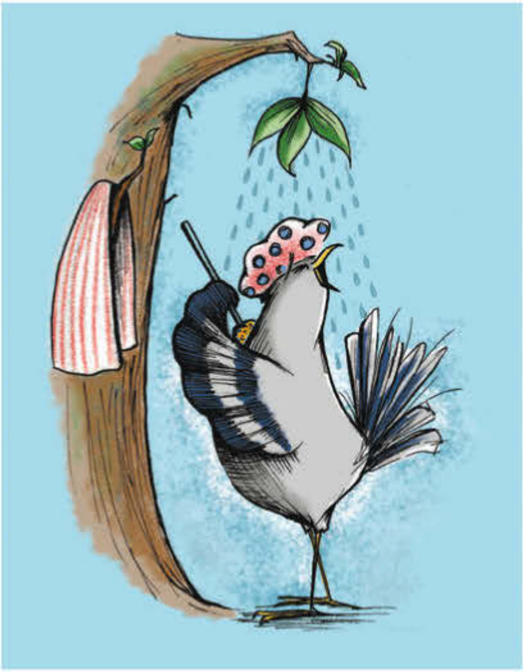
Dear Pili,
Where is this Island of Pranks? How do I get there? Do they have a king yet? Will you vote for me? I'm going to invent a robot that looks like me and also makes more of itself, so there will be 1,000 Marvin the Pranksters!

Vote for us!
Marvin(s)

April Contest

Beast Bath

To keep clean, people like to cover themselves in soap and sit in tubs. This must look pretty odd to the animals. But animals have their own ways of taking baths. Birds bathe in dust. Elephants slather themselves in mud. And raccoons . . . we can only guess. For this month's contest, draw us a picture of how your own favorite animal takes a bath (or, how you imagine it might). We'll show off the squeaky-clean menagerie in an upcoming issue of *Ask*.



Contest Rules:

1. Your contest entry must be your very own work. Ideas and words should not be copied.
2. Be sure to include your name, age, and address on your entry.
3. Only one entry per person, please.
4. If you want your work returned, enclose a self-addressed, stamped envelope.
5. Your entry must be signed or emailed by a parent or legal guardian, saying it's your own work and that no one helped you, and that *Ask* has permission to publish it in print and online.
6. For information on the Children's Online Privacy Protection Act, see the Privacy Policy page at cricketmedia.com.
7. Email a photo or scan of artwork to: ask@cricketmedia.com, or mail to:
   Ask, 1 East Erie Street, Suite 525,
   PMB4136, Chicago, IL 60611
   Entries must be postmarked or emailed by April 30, 2023.
8. We will publish the winning entries in an upcoming issue of *Ask*.

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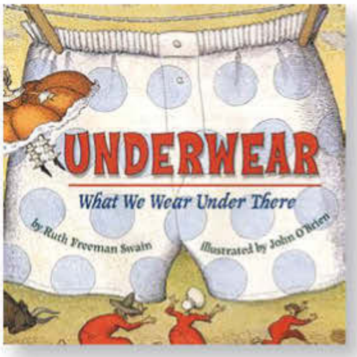
Whatson's BOOK CORNER

Underwear: What We Wear Under There

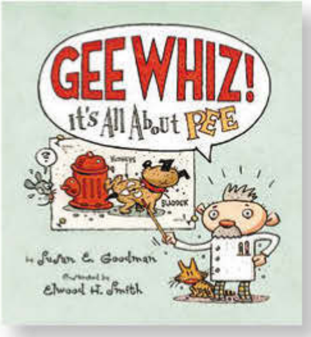
by Ruth Freeman Swain


UNDERWEAR
What We Wear Under There
by Ruth Freeman Swain
Illustrated by John O'Brien

Kings and revolutions are all very well, but sometimes it's fun to take a peek into the hidden parts of history. In this amusing romp through the history of undies, you can see what kings and grandmas wore underneath, and how your own underwear got the way it is. It will give you a new appreciation for elastic.

Gee Whiz!

by Susan E. Goodman

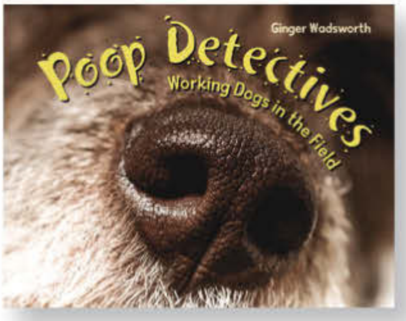

GEE WHIZ!
It's All About PEE
by Susan E. Goodman
illustrated by Elwood H. Smith

Why do we pee? Do fish? Why is bird pee white? How did knights in armor go to the bathroom? Find all the answers here, plus see an amazing invention for peeing far away, and learn how pee is used for making everything from dye to fireworks. And if your mom has not banned you from the library yet, check out *The Truth about Poop* too.

Poop Detectives

by Ginger Wadsworth

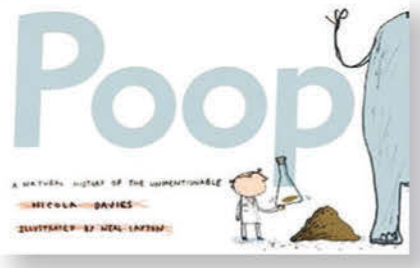
This fun book tells the story of some special dogs who help wildlife researchers by sniffing out scat (or poop) of wild and endangered animals—even whales! Scientists can use scat to count animals in an area, check DNA, learn what the animals have been eating, and see how healthy they are. A job any dog would love!


Ginger Wadsworth
Poop Detectives
Working Dogs in the Field

Poop

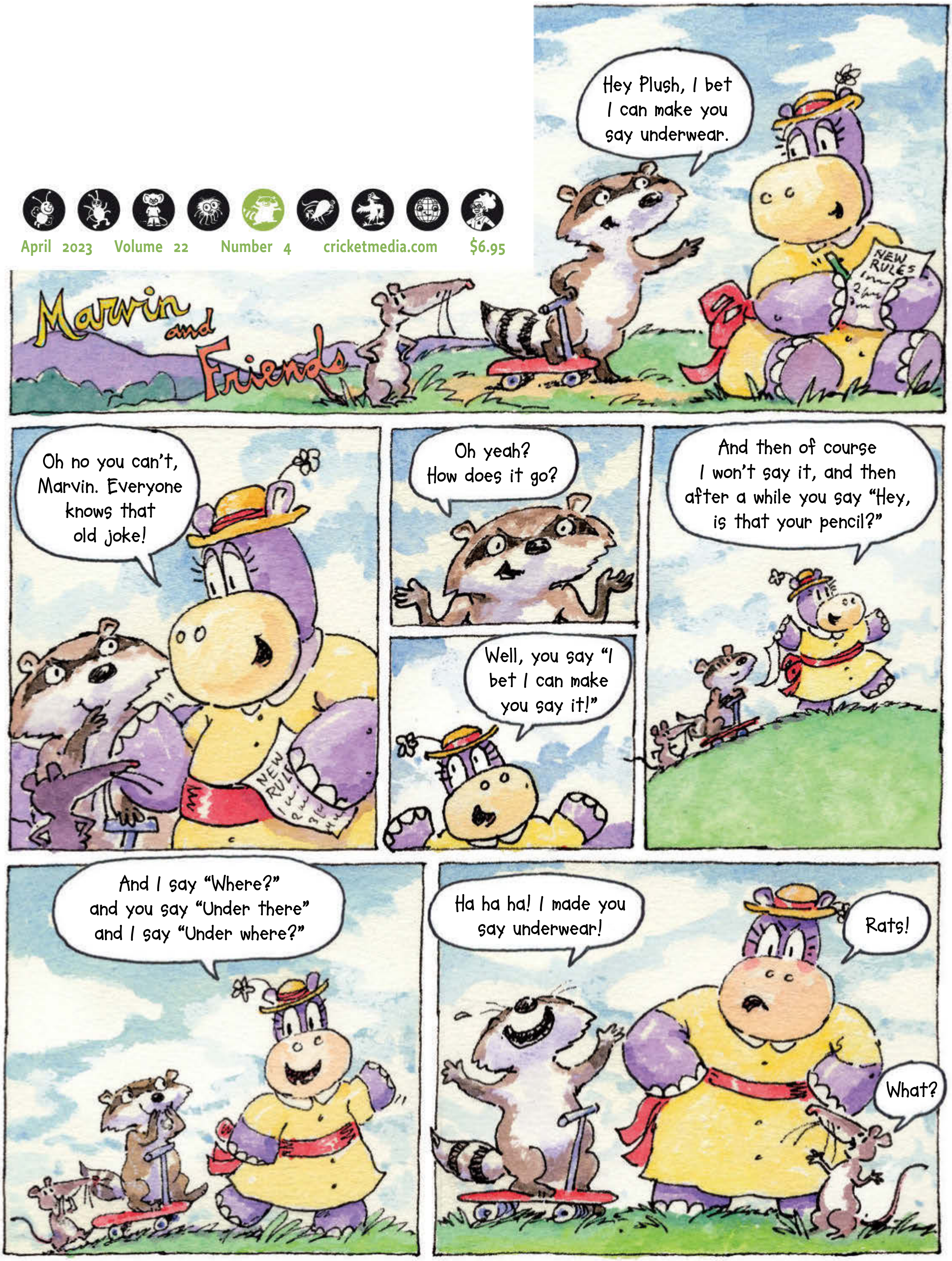
by Nicola Davies

People, birds, elephants, even flies—everyone poops. You can find out everything you ever wanted to know (and some things you didn't) about the last bit of the digestive process in this amusing and fact-packed book. Learn to recognize animals from their dung, how to make rainbow poop, and meet a caterpillar disguised as bird droppings. I'll never look at rabbits the same way again.


Poop
A natural history of the unmentionable
Nicola Davies
Illustrated by Neal Layton

April 2023 Volume 22 Number 4 cricketmedia.com $6.95

text and art by Thor Wickstrom


Marvin and Friends
Hey Plush, I bet I can make you say underwear.
NEW RULES
Oh no you can't, Marvin. Everyone knows that old joke!
Oh yeah? How does it go?
Well, you say "I bet I can make you say it!"
And then of course I won't say it, and then after a while you say "Hey, is that your pencil?"
And I say "Where?" and you say "Under there" and I say "Under where?"
Ha ha ha! I made you say underwear!
Rats!
What?